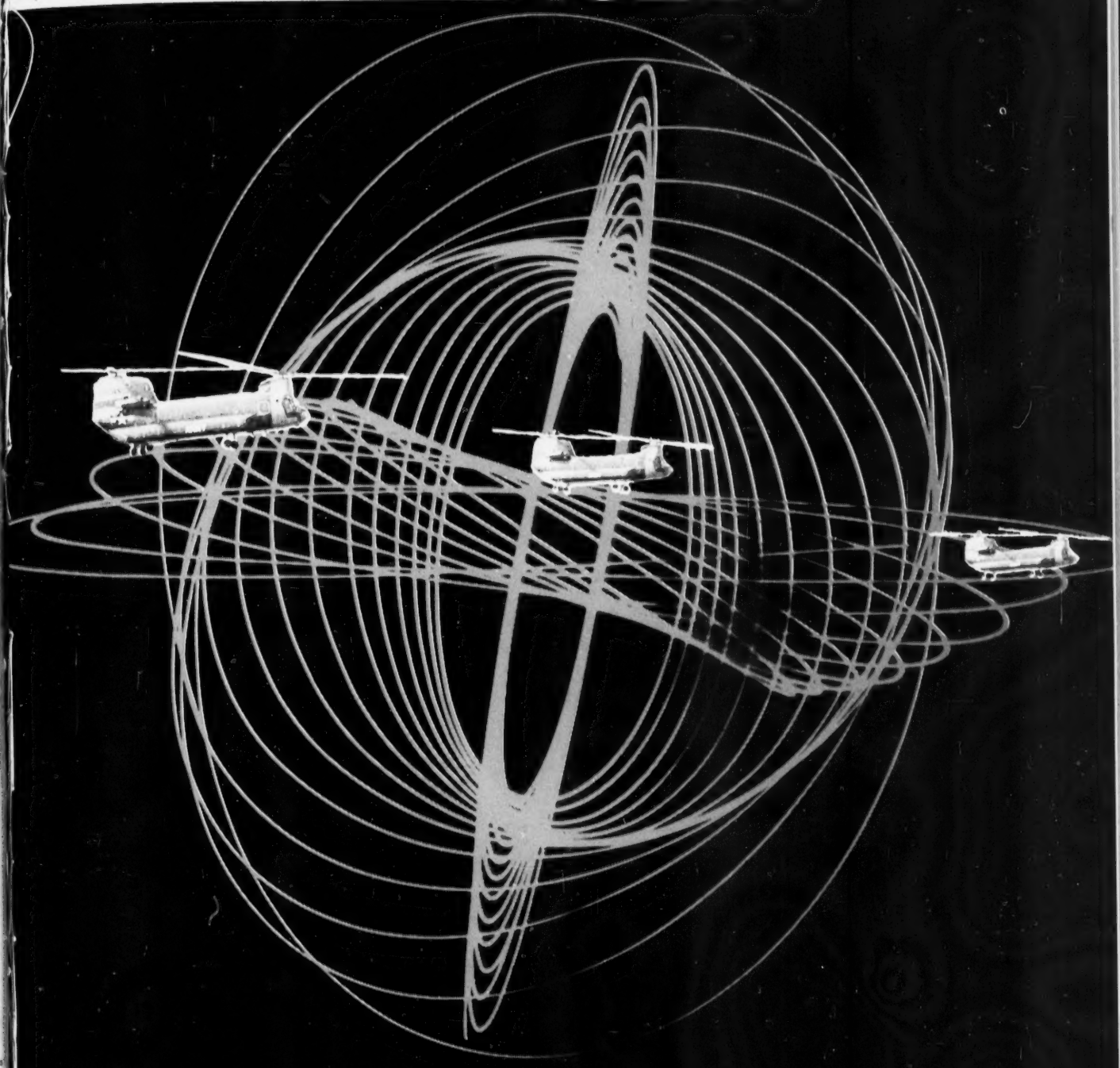
UNITED STATES ARMY AVIATION DIGEST



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CONTENTS

Advanced Research and Development Progress, Capt Charles M. Scott, Jr. 2

Formation Flying With Microvision, Capt Charles H. Mattison 8

Terminal ADF Approach, Maj Frederick L. Clapp 10

Ideals and Realities, Capt George F. Christensen 15

The Real Problem, Maj Richard A. Humes 17

Copter Instruments Tactical and Practical, Maj Nelson E. Luce 20

Who Do You Want To Go?, Maj Milton P. Cherne 23

Helicopter Tactical Employment, CWO Rex Flohr 28

Helicopter Instrument Flight, Eighth U. S. Army Aviation Section 32

Carry On, Maj Milton P. Cherne 35

When Does An Instructor Take Over Controls? Maj W. W. Vatcher (Ret) 38

Crash Sense, Capt Lawrence F. Beyer 40

Maintenance Man on the Aviation Team, Gerard M. Bruggink 46

The mission of the U. S. ARMY AVIATION DIGEST is to provide information of an operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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Articles, photos, and items of interest on Army Aviation are invited. *Direct communication is authorized to: Editor-in-Chief, U. S. Army Aviation Digest, Fort Rucker, Alabama.*

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Helicopter Instrument Issue Awards

Major General Clifton F. von Kann
Commanding General, U. S. Army Aviation Center
Commandant, U. S. Army Aviation School

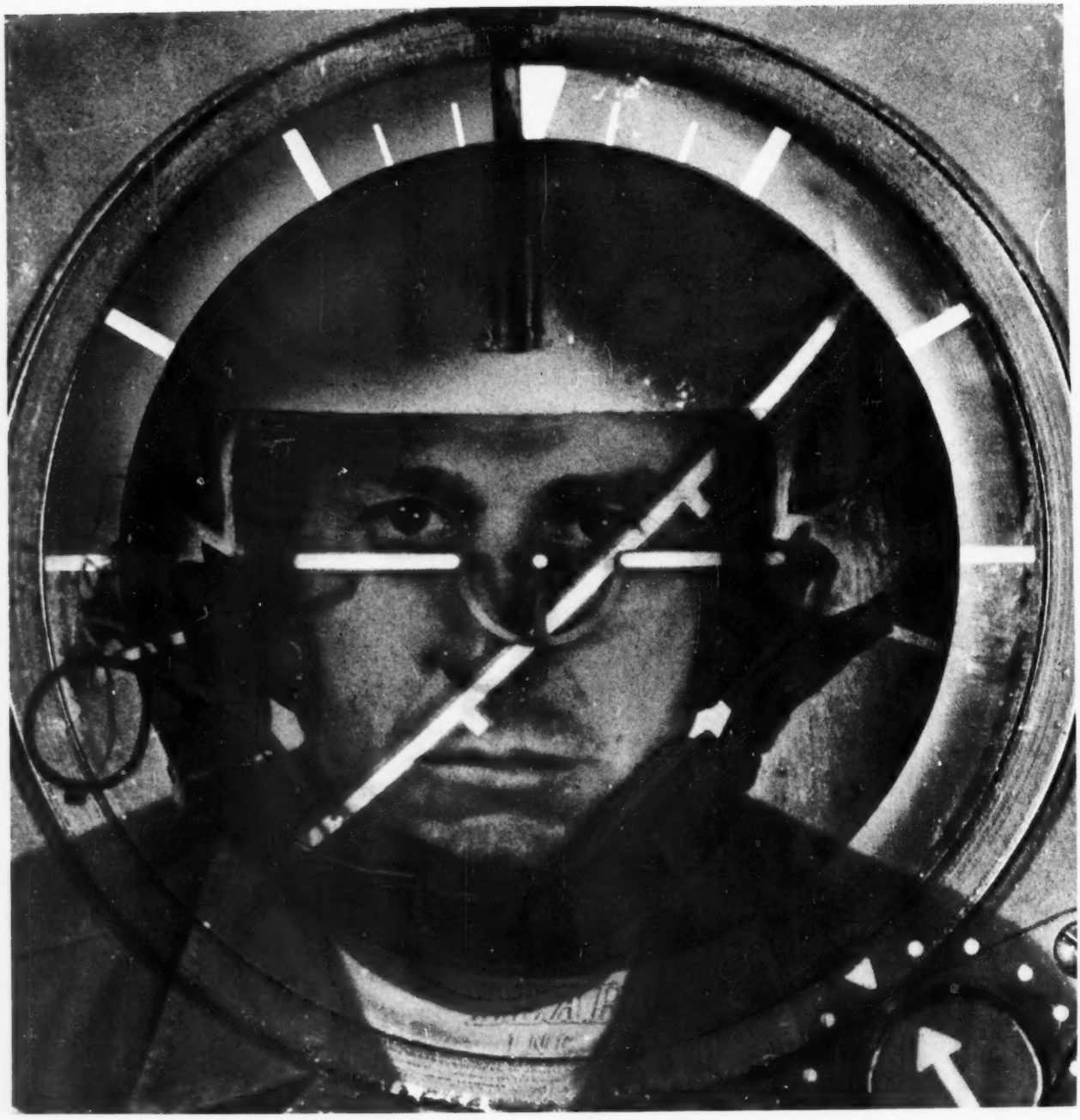
This issue contains the 10 best articles submitted in response to my May request on helicopter instrument flying. We read all of them with great interest and enjoyment because they not only covered the subject but touched on most of the practical problems found today in the field of Army Aviation. I therefore hope that all readers will spend some time with this fine group of articles.

Selecting the winning article posed a problem. We had one outstanding article on the research and development aspects of helicopter instrument flying and several on the more practical problems encountered using existing equipment. We therefore decided to select one of each type of article and to award two first prizes of $100 each to the two authors involved.

It is therefore with great pleasure that I announce that one award of $100 will be made to Major Richard A. Humes for his fine article on the practicalities of current instrument flying entitled "The Real Problem." A similar award will be made to Captain Charles M. Scott for his excellent article entitled "Advanced Research and Development Progress in Helicopter Instrument Flying."

Let me also thank the many other individuals who submitted articles. All will be turned over to the Combat Developments Command Aviation Agency and the Department of Tactics of the U. S. Army Aviation School so they may be used in the further development of instrument helicopter flying doctrine.

Advanced Research and D
In Helicopter Instrument F



Development Progress Flying

Captain Charles M. Scott, Jr.

INSTRUMENT FLYING techniques and equipment for Army helicopters today remain, with minor exceptions, in the same status as was fixed wing instrument flight near the end of World War II. The helicopter instrument flight product is, however, a much more severe test of the aviator's skill and concentration through the forced integration of additional data inputs and required control outputs. The major key to simpler instrument techniques, thus more profitable mission effectiveness, is relief of the pilot from many of the tedious, time- and effort-consuming tasks that are required in helicopter instrument flight.

The quickest and most complete solution to this problem is the delegation of these tasks to some measure of automatic control — whether it be mechanical, aerodynamic, or electronic. This delegation of tasks is not intended to make a pilot lazy or sloppy; instead, it will allow him to concentrate on tasks that cannot be handled by automation. These tasks include tactical decisions and control measures necessary for successful mission accomplishment.

Army Aviation has been slow to accept any type of automatic control in its aircraft. However, a few devices have joined the inventory and have been received with attitudes varying from mere acknowledgment to wild enthusiasm. These devices run the gamut from automatic engine/rotor speed control, through automatic flight control systems, to instrument flight director - type systems. These systems are designed primarily to relieve the pilot of his observe - assess - operate cycle of action in their particular areas of control. The three major areas of helicopter control are

- engine rotor speed control
- attitude control, and
- flight path control.

ENGINE/ROTOR SPEED CONTROL

Efforts were made in Army Aviation as early as 1956 to effect both mechanical and electromechanical control of engine rpm automatically, thus relieving the pilot of the major portion of effort required for maintenance of rotor speed. These efforts reflected technological capabilities at that time and were, operationally speaking, very successful. However, even after satisfactory test agency reports, no move was made to implement their findings. It can probably be argued that with the gas turbine this electromechanical or mechanical throttle control would be outdated. This is true for turbine powered vehicles, but it leaves the Army with about 1,000 reciprocating engine-driven cargo helicopters with no relief at all.

When UH-1 aircraft came into general use, many loud praises were heard for the automatic speed-governing fuel control on the T-53. The pilot no longer has to continually trim engine speed, along with myriad other cockpit duties. This same automation is present in the CH-47A and also in the OH-4, 5, and 6. The pilot merely makes beep-switch adjustments to trim rpm. He knows that his industrious, never-tiring servant — the fuel control — has assumed the responsibility for this flight variable.

Thus, we may conclude that for the present we have relieved the pilot as much as possible in this area. The only additional area of improvement may lie in automatic adjustment (beeping) of the rpm control as scheduled by some other automatic control device; i.e., for climb power as demanded by a terrain avoidance radar (TAR) coupler.

In this article, automatic flight controls are discussed under the subhead of attitude control, and flight director systems are discussed under flight path control. This is not to infer that these systems are restricted to these uses; it is only a convenient method of organization. Properly coupled automatic flight control equipment provides full flight path control, while flight director systems present commands for basic attitude control as an integral function.

ATTITUDE CONTROL

Automatic flight control sys-

Development agencies are implored to solve recurring problems of all-weather flight

tems (AFCS) are one of the most controversial topics in the Army Aviation avionics field. Almost every system tested over the past 8 years has provided an increase in capability and a reduction of overall pilot effort. However, instant and loud opposition seems to spring up at the mention of AFCS, stability augmentation systems (SAS), or autopilots. This seems strange when every speaker or paper concerning Army Aviation implores development agencies to solve the recurring problems of all-weather flight, nap-of-the-earth flight, operations in unchartered areas without ground navigational aids, and formation flight in marginal and instrument weather.

Capt Scott, USAR, is assigned to Hq Company, 1st Brigade, 63rd Infantry Division. He is Military Marketing Representative (Army) for Sperry Phoenix Company, Arizona.

To date, only aircraft with an engineering requirement for stable operation (e.g., SLAR equipped OV-1Bs, and M-22 equipped UH-1Bs) have had automatic flight control devices installed during production. The CH-47A requires a dual three-axis SAS to enable it to approach the military specification for helicopter handling characteristics.

During 1957 and 1958, service tests were performed on automatic stabilization equipment (ASE) in CH-34 and CH-37 aircraft. Test reports stated a significant increase in instrument capability, so a retrofit program was authorized. Later testing demonstrated the desirability to couple with navigational aids such as VOR, ILS, or Doppler. The results of these stabilization programs have yet to be implemented in other aircraft, even though nearly 2,000 new helicopters have since entered the inventory.

Perhaps the opposition has been only to electronic or electromechanical systems, because UH-1 aircraft in production today are equipped (as was the OH-13) with a mechanical SAS of limited effectiveness. This mechanical SAS is the stabilizer bar which achieves a degree of stability for the aircraft but does not begin to approach the effectiveness of electronic systems.

Thus, we find that one of the two major areas left for improvement of instrument flying capabilities has remained relatively untouched. It is possible to add sufficient stability to rotary winged aircraft that their handling characteristics will exceed those of most stable, unaugmented fixed wing aircraft. This additional degree of stability in the helicopter will relieve the pilot of the bulk of his largest chore — that of continually monitoring and trimming aircraft attitude.

Flight control assistance can take one of two forms. First, a limited authority, full-time SAS can be implemented to impart short-term rate damping to the basic aircraft. This can give the helicopter the single greatest advancement to be gained by additional equipment toward its goal of efficient instrument flight.

Second, a full AFCS, capable of long-term control of aircraft attitude and of accepting external signals to control flight path, should be implemented. In the past, this category of equipment has been in the nice-to-have group and has been used to couple with VOR, ILS, ADF, and Doppler navigators. Today, with requirements rapidly solidifying for formation flight under instrument conditions, low-level terrain following, and blind landing, this type of automatic flight path coupling appears to be the only answer.

The AFCS will provide neces-

sary control inputs in response to external sensors to allow the aircraft to maintain its formation position, terrain clearance, or flight path. Commands from these sensors will be generated so rapidly that the delays associated with human operator assessment and response will be unacceptable, especially if the cues are subject only to periodic attention during the instrument scan procedure. Thus, an AFCS appears to provide the only means for safely extending helicopter instrument flight into these modes.

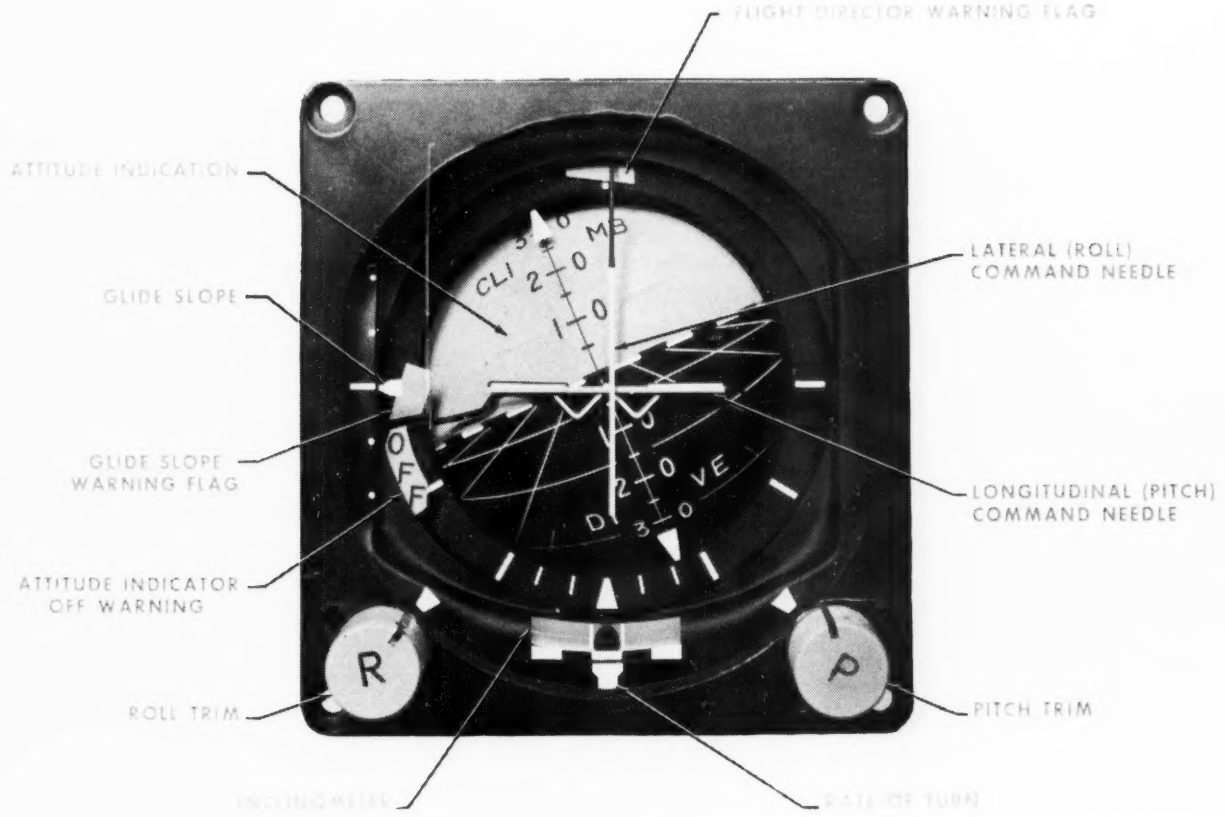
Since the aviator will now be at the center of a series of electromechanical systems, a measure of redundancy must be achieved within the control and data display elements. The generation and use of these flight commands in the AFCS, and in the display of the visual cues to the pilot, will be discussed in the following section. As will be shown, the data displayed to the pilot will follow simultaneously, or "track," those supplied to the AFCS that result in control of the aircraft. Thus, the pilot will be able to monitor the AFCS controlled aircraft and detect any discrepancy between the controlled flight path and the instrument display system cues.

FLIGHT PATH CONTROL

Flight path control is the operation performed to direct an aircraft on the desired track, both in a horizontal and vertical sense. The simplest flight plan regime is that of attaining and maintaining a desired heading and attitude. Flight path demands could conceivably be increased to the point that an aviator would be required to maintain a formation position in a low-level terrain following (radar evasion) mode under complete instrument conditions. This may well be an extreme; however, it does point up the multiplicity of displacement data that a pilot must integrate to determine which way, how much, and how fast to move each of his four controls. Flight director systems can reduce this data into simple commands for each of the affected axes.

As early as 1946, integrated instrument system development was moving along rapidly. The initial work in this area took the form of the zero reader flight director. This two-axis

Figure 1. Remote Attitude Director Indicator (RADI)



(lateral and longitudinal) flight director is now standard equipment in the U. S. Air Force and in many commercial airlines. The Army, as the result of a comparative evaluation in 1957, chose a single-axis (lateral only) integrated flight system — the AN/ASN-33 — for installation in the OV-1 Mohawk. Test work followed on the two-axis helicopter flight director with encouraging results; however, this work was not pursued and thus has found no production acceptance.

All flight director systems work in the same general manner. Data normally monitored by the pilot for each of his separate axes of control is fed electrically into a computer, along with the desired flight path information (heading, track, horizontal and vertical position). The output of this computer positions a command bar on the remote attitude director indicator (RADI) (fig. 1).

In the case of a two-axis system, it commands the pilot to fly the miniature airplane in the center of the instrument to intersection of the bars. This is accomplished by moving the cyclic control in the proper direction, as though remotely controlling the miniature aircraft. Since the computer can determine rates of bank, pitch, and turn, it anticipates the movement of the helicopter and will automatically arrive at and hold the desired flight path as long as the bars are kept centered.

In the lateral (steering) axis of a helicopter on a VOR track, for instance, the computer uses the following displacement and rate signals to determine the command bar deflection:

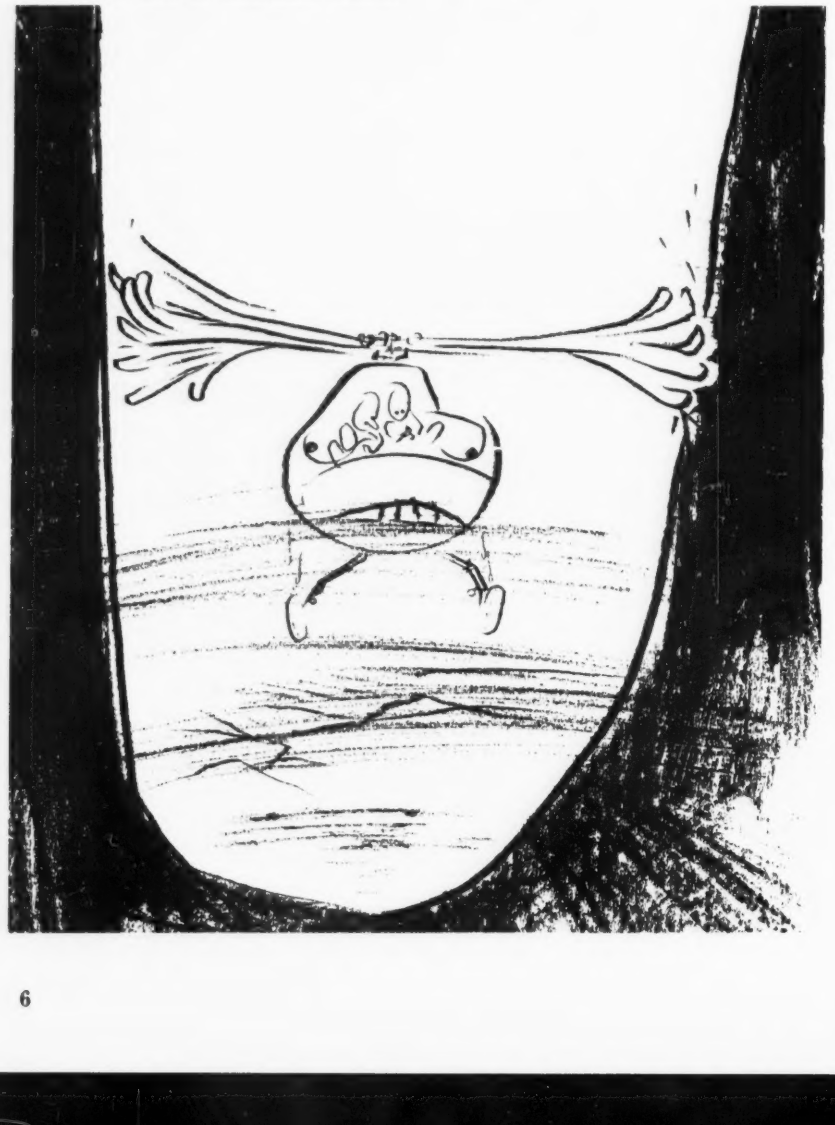
roll attitude,
roll rate,
aircraft heading,
heading rate,
selected course, and
course displacement.

Thus, when any of these factors begins to change improperly, an immediate deflection of the command bar is made to indicate to the pilot which direction and how much correction is necessary to regain his desired flight path. The same is true for the the cyclic pitch command bar.

External data fed into the steering channel can be from VOR, ILS, ADF, Doppler or inertial navigators, a terrain guidance radar, or a station-keeping (formation) radar. Pitch channel data can be from an altitude hold, airspeed, rate of climb, glide slope, terrain avoidance, or station-keeping sensor. At this point it should be noted that while few three-axis or more helicopter flight director systems have been flight tested, laboratory simulator tests have shown that little is gained by providing commands for other than the cyclic control. In fact, tests have shown a decreasing acceptance of the two-cyclic indications when collective and yaw commands are displayed.

Much development work remains in the field of how to display altitude or terrain clearance control (minor climb/descent adjustments are made with cyclic, while major changes require collective). Likewise, much is to be learned from flight testing

Much development work remains in the field of how to display altitude or terrain clearance control



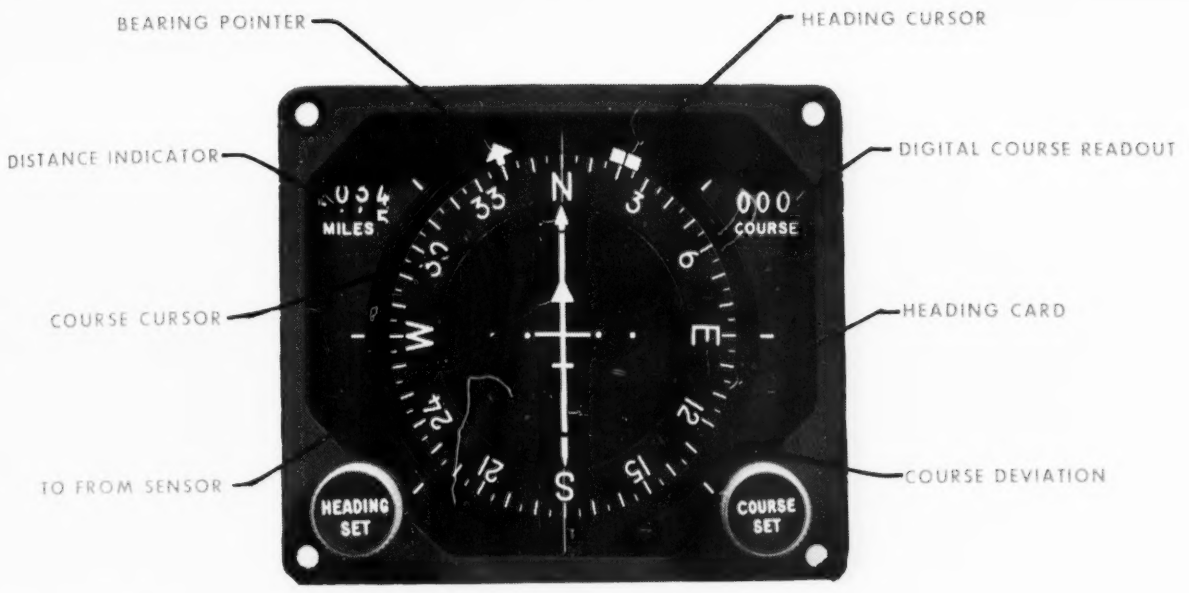


Figure 2. Horizontal Situation Indicator (HSI)

station - keeping radar couplers that involve not only horizontal and vertical position, but also longitudinal position in the formation as well. However, it would seem that a flight director presentation holds much promise in this area, since it has the ability to combine the extra inputs and still emerge with only the commands necessary to position the cyclic stick. This again returns to mind the developmental tasks ahead in the integration of collective/longitudinal cyclic commands for climb/airspeed/position control.

One training advantage that appears is that exactly the same procedures are used in all modes of flight (fly the helicopter to the bars!). Thus, it may be generalized that terrain following formation instrument flight techniques will be no more complicated or exhausting than present airways instrument flight (a rather hairy generalization!).

The horizontal situation indicator (HSI) (fig. 2) complements the RADI. HSI presents all information concerning aircraft heading, course, and track, and it also provides a bearing pointer for use with VOR, ADF, or navigator target bearings. Only airspeed and altitude/rate of climb instruments are needed to complete the flight data display; hence the name "integrated" systems.

Since we have departed from the automatic flight control ideas for a moment, it might be well to consider the addition of these same signals to the AFCS. This action will then cause the AFCS to keep the helicopter in the desired position without further pilot effort. The action of the AFCS should keep the flight director bars centered at all times, despite the fact that they are two separate computer systems. In this manner, each system provides an instantaneous and accurate check on the other. If a discrepancy occurs, the pilot need only refer to his basic displacement instruments to determine the offending system.

This separate system comparison can be performed today in OV-1 aircraft where the action of the AN/ASN-33 computer set, navigational, may be monitored against that of the AN/ASW-12(V) universal automatic flight control system. These redundant automatic control systems provide the pilot with sufficient relief to enable him to perform his primary mission most effectively.

Modern day technology is adding tactical missions and new sensor equipment for helicopter use faster than the development procurement cycle has been able to equip aircraft to use these advances. Army Aviation has completed several very valuable and tactically sound evaluation programs clearly indicating major advances can be made in helicopter instrument flight operations.

It is believed that with the addition of aircraft stability through SAS/AFCS equipment and resolution of the many data inputs into flight director commands, the greatest strides in mission effectiveness can be made for helicopter instrument flight. Engineering technology and research and development agencies are abreast of the problem. The question is "When will tactics and doctrine follow?" ☆

Formation Flying With Microvision

Captain Charles H. Mattison

WE OF THE 11th Air Assault Division (T) have been concerned with moving large formations of UH-1D troop-carrying helicopters to our objectives in all types of weather. Weather has been one of our biggest enemies. It has fought us in many forms and has won the battle in most cases.

It has stopped us when it existed as a general widespread condition, and it has stopped us when it existed only at the point of origin. It has stopped us when it existed only at our objectives, and it has stopped us when it existed only as a small, impassable block between our origin and objective. Small wonder that we are interested in a means of moving our formations of UH-1Ds through various forms of weather for periods of 5 minutes and more.

During the past several months I have been working with engineers of the Bendix Corporation, Eclipse-Pioneer Division, in conducting tests with Microvision as applied to UH-1D formation flying. Microvision as used at Fort Benning, Ga., consists of three main elements: the airborne transmitter, the airborne receiver, and the pilot's display.

The transmitter consists of two beacons, approximately 10 feet apart, radiating from horn antennas located at the base of the horizontal stabilizer on the UH-1D. This furnishes a known base line from which to obtain range by triangulation. These transmitters send pulses about one microsecond in length at a rate of approximately 400 per second.

The airborne receiver consists of two pairs of receiving horns which are mounted at an angle to each other on the nose of the UH-1D. This assembly is about 10 inches side to side. Crystal detectors on the backs of these horns produce a video signal which is conducted by coaxial cables to the preamplifier package inside the aircraft.

The preamplifier package transmits its signal to a small cathode ray tube, forming two bright spots on the tube. The picture formed on the cathode ray tube is transmitted to the pilot's display by a collimating system. A lens system is used to transmit a visual image of the cathode ray picture onto the pilot's display.

The pilot's display consists of a combining mirror, that is, one which acts as a mirror for the Microvision picture and as a window for the

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pilot's direct sight of the aircraft ahead, weather permitting. The two bright spots formed on the combining mirror appear as though they were lights coming from the transmitting horns of the lead aircraft. In other words, the pilot is able to look through the display at the lead aircraft, visibility permitting, and at the same time see the two bright spots generated by the transmitters of the lead aircraft. These bright spots, or lights, are visible at all times, even though the pilot may not be able to see the leading aircraft.

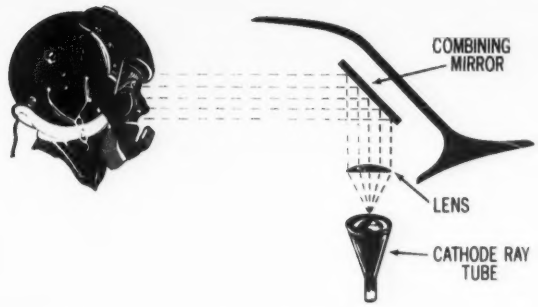
In addition, an artificial horizon and a range limit scale have been incorporated into the combining mirror display. The artificial horizon shows the pilot the pitch and roll of the aircraft. The range limit display consists of a vertical line which represents the preset close range limit at the top of the line and the far range limit at the bottom of the line. A small horizontal line moves up and down the vertical range line, acting as a pointer on the range limit line, showing the relative range from the aircraft in front.

The Microvision display that the pilot sees on the combining mirror includes an artificial horizon, a range scale, and the two bright spots. A diagram of this display is shown (right). This display is overlayed on the actual scene so the pilot is able to see outside the cockpit.

At this point I think it is time to enlarge on the function of the two bright spots. These spots follow the lead aircraft wherever it goes. Consequently the pilot's display will show the position of the lead aircraft at all times. This is limited only by the angle between the transmitting beacons of the lead aircraft and the receiver of the following aircraft. This angle was limited to 15° either side of the center on the equipment we used at Fort Benning.

Another aviator and I spent approximately 2 hours each becoming familiar with the Microvision equipment. After this period, we flew the follow aircraft completely hooded off from the outside world. We were able to follow the leading aircraft through all the standard maneuvers for periods up to 30 minutes. (We both feel that we could have continued for longer periods of time.)

During these hooded flights we experienced few difficulties in following the lead ship, even though we had no prior knowledge of what maneuver it would perform. The greatest difficulty was maintaining a constant range between the two aircraft. I believe the range information furnished by this system needs to be improved. It needs a larger and more sensitive scale; it must show a small change in range much more rapidly.



Optical schematic of pilot's display

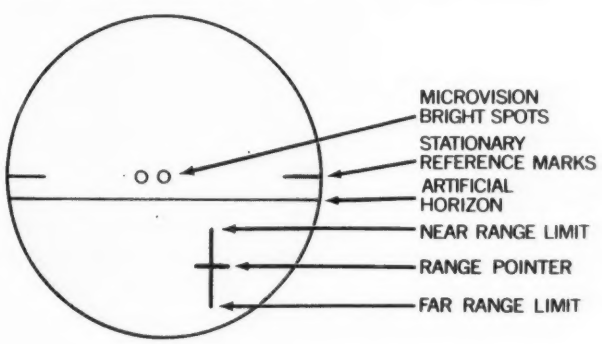
The artificial horizon also needs some small improvements, which should not be difficult to work out. Many problems in this system could probably be overcome by installing the transmitting antenna in the tips of the main rotor blades. This would seem to be the next logical step in testing Microvision.

We flew the system at night without the hood and found that it did not offer much assistance to our present method of night formation flying. However, it does offer the advantage of flying night formation with all navigation and formation lights off. A completely blacked-out night formation could be a very desirable formation under some tactical situations.

We also tried making hooded approaches to a field location using Microvision. In this application the transmitting beacons were positioned on the landing site. We were able to use Microvision as a letdown system and made several approaches to within 150 to 200 feet above the ground. With further research and improvements to the system, I think approaches to within 50 or 25 feet above the ground will be possible.

We have proved that Microvision in its present form will work as an instrument formation flying device. However, many desirable improvements should be added before Microvision will be the complete answer to instrument formation flying.

Two bright spots on pilot's display show location of lead aircraft at all times



Terminal ADF Approach

Major Frederick L. Clapp

TODAY HELICOPTER development has progressed little beyond employment of the inherent transportation capabilities. However, even exploitation of the enormous transport potential of the helicopter is neglected during periods of poor weather.

This is true because we in Army Aviation have, for all practical purposes, imposed on helicopter instrument flying the same regulations that govern fixed wing aircraft. In doing this we completely ignore the advantages rotary wing aircraft enjoy over fixed wing. As a result we have not trained our people and used our equip-

Maj Clapp is CO, 55th Avn Company (Army), Eighth U. S. Army, Korea.

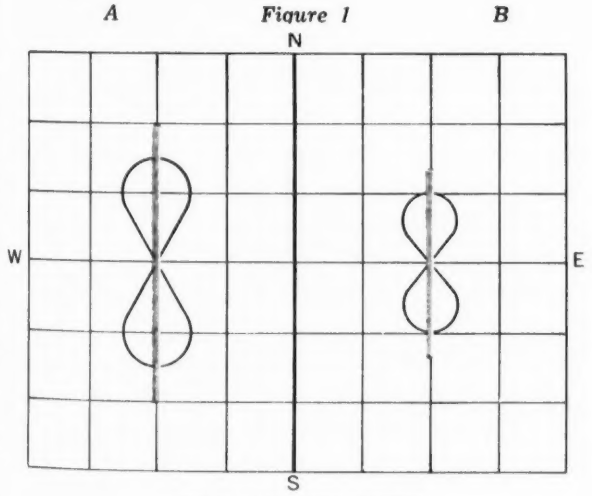
ment, on the grounds that such a program is too dangerous.

Before describing a method of providing IFR aviation support during tactical operations, I think it is necessary that we first conduct a short review.

Let us consider the relatively small area required to maneuver the helicopter. At 60 knots (no wind), making all turns standard rate, the chopper will never exceed an area over the ground larger than 3,000 meters long and 1,200 meters wide. If speed is reduced to 40 knots the area will not exceed 2,000 meters by 800 meters. With this information and basing all distances on 60 knots, even though we intend to use 40 knots for our letdown and approach, we can now construct a template drawn to the scale of our map. This template can then be used to select beacon locations and intended landing areas (see fig. 1).

Figure 1 assumes final approach axis will be either to the north or the south. The beacon must be placed in a location that avoids any obstacle higher than 100 feet within a distance of 1,000 meters east and west and 2,000 meters north and south from the beacon as shown.

Figure 1A indicates the over the ground distance required to maneuver a helicopter at 60 knots, making all turns standard rate. Figure 1B indicates the required distance when airspeed is reduced to 40 knots. Predicating all descents and approaches on 60 knots, beacon locations can be selected any place on the map which will accommodate the template shown in figure 1A. Reducing airspeed to 40 knots provides a further safety margin in addition to the 100-foot obstacle restriction at 1,000 meters east and west and 2,000 meters north and south along the approach axis. Note: Green line indicates direction of approach or approach axis.



SCALE 1:100,000 METERS

Our next consideration is what beacon to use. We are restricted here in that most TOE units are limited to either the radar set AN/TPN-8 or the beacon set AN/GRN-6. I rule out the radar because of ground clutter and other problems when operating close to high terrain features. However, the AN/GRN-6 beacon has proved very reliable and can be used for IFR approaches without the approach first being tested under VFR conditions.

Repeated hooded approaches to this beacon, located at field sites, have been successfully made to an altitude of 100 feet above the ground. In the hands of trained personnel, both air and ground, I am confident safe IFR approaches can be made down to 100 feet with visibility of ¼ mile.

Assuming we wish to move a number of helicopters from point A to point B we first refer to our map. Using our template, we locate a position close to point B that meets the required minimums. We then draw a course line directly from point A to point B. We determine the magnetic heading to be 140° and the distance to be 30 nautical miles. Further study of the map reveals ground elevation at point B to be 70 feet. We also learn that the highest terrain feature within 10 nautical miles left or right of our course line is 2,400 feet in elevation.

At this time we dispatch the airfield facilities NCOIC with his AN/GRN-6 beacon to the coordinates at point B.

In view of the 2,400-foot terrain elevation we elect to cruise at 3,500 feet and 80 knots indicated airspeed. At 80 knots, flying time (no wind) will be 23 minutes.

In that point A is a main airfield, the unit AN/TPN-8 GCA set is operating at that location. Radar will be able to track all aircraft for a distance of 20 nautical miles on a heading of 140°. This service will be used to establish track in the event terrain initially interfers with the beacon signal from point B.

At the time of takeoff, weather at point A is 200 feet overcast, ½ mile visibility in fog, and winds are calm. The forecast calls for slow improvement during the next 12 hours. Winds aloft are reported from 180° at 10 knots. No weather is available for point B, and no communications have been established. The flight leader elects to use point A as his alternate. Point A does not meet regulation alternate minimums; however, repeated tests have shown safe helicopter GCA approaches can be effected to the ground if necessary.

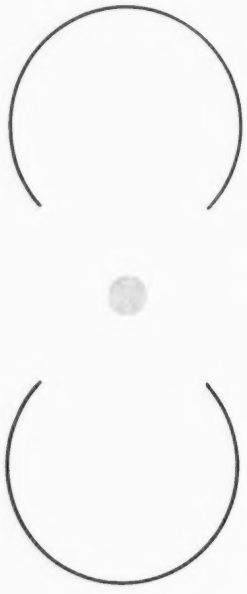
A review of the area weather map indicates point B is in the same pressure area as point A; therefore, no major altimeter change is expected between the two points. Just before takeoff all pilots placed point A field elevation on their altimeters and did not reset until after landing at point B.

The flight, consisting of six UH-1 aircraft, departed point A at 5-minute intervals. After takeoff the aircraft climbed to 3,500 feet on a heading of 140°. With radar assistance it was determined that a heading of 142° would make good a 140 track. Ten minutes after takeoff the beacon at point B was tuned, identified, and radio contact was established on FM.

The airfield facilities NCOIC informed the flight leader that point B weather was estimated to be 200 feet overcast with ¼ mile visibility in fog, winds calm. In addition, the beacon site and landing area had been reconnoitered and there were no obstacles within 1,000 meters left or right and 2,000 meters in either direction from the beacon along the approach axis. Ground reconnaissance by the airfield facilities NCOIC is very important in that manmade obstacles would not likely appear on the map.

During the map planning phase of the mission, it was determined that the beacon site would be located in a small valley running from northwest to southeast. The general approach heading appeared to be 340° or 160° magnetic. However, the facilities NCOIC, after his ground reconnaissance and using a lensatic compass, selected 170° magnetic as the final approach heading.

Figure 2. The beacon location is shown in green. The four black legs of the pattern are each 15 seconds in length. The 270° turn, shown in grey, requires 1½ minutes at standard rate. One complete pattern requires an elapsed time of 4 minutes.



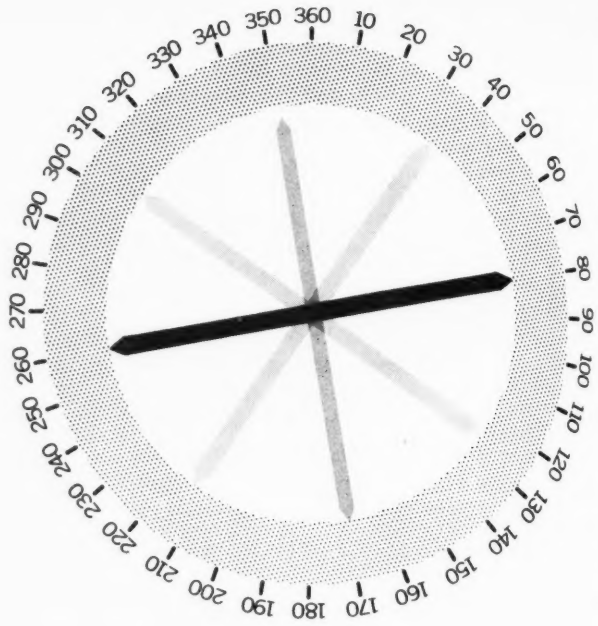


Figure 3. A pilot, upon being notified that 170° is final approach heading, rotates the final approach arrow of his computer to 170 as shown in green. He is then able to read the inbound and outbound headings of the figure eight letdown pattern directly from the computer, as shown in grey. His initial outbound figure eight heading is the nearest grey arrow heading to that of his aircraft upon reaching the station. The arrow shown in black allows the pilot to read directly his 90-270 procedure turn letdown heading, either left or right of the reciprocal of the final approach heading.

Upon arriving at high station at 3,500 feet, the flight leader reduced speed to 40 knots and turned to his outbound heading. He let down at a rate of 500 feet per minute until reaching 1,070 feet indicated, which is low station altitude and 1,000 feet above the ground. The approach consisted of nothing more than a letdown during a 90-270° procedure turn, and will be described in more detail later.

A figure eight pattern is used for the letdown from high station to low station altitude (see fig. 2). Two reasons exist for selecting this pattern over the standard race track pattern. One, the figure eight pattern confines all maneuvering to an equal distance on both sides of the beacon

along the approach axis. Two, it affords the pilot an opportunity to reestablish his position over the beacon twice during each complete pattern, as opposed to once in a standard race track.

Upon reaching high station the initial outbound heading is determined by the final approach heading, received by FM radio from the ground, and the use of a computer. The final approach heading for the flight I have described was 170° (see fig. 3).

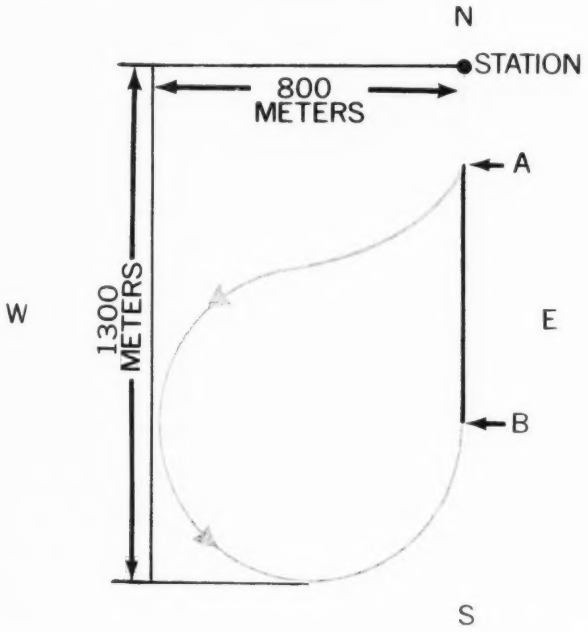
Flying the helicopter requires the full attention of the pilot; therefore, the copilot performs all necessary computations. The copilot informs the pilot when to reduce airspeed, what heading to fly, when to turn, and when and what rate at which to descend. In addition, it is the duty of the copilot to land the aircraft when VFR ground contact is established.

Rates of descent should not exceed 500 fpm. This will provide the copilot adequate time to determine wind direction and necessary drift corrections. While descending in the figure eight pattern, do not be concerned if inbound headings to the station are off as much as 30°. Outbound headings, however, are very important. As an example, let us assume we have just arrived at high station. Our final approach heading is 360° and our aircraft heading is 050°. The copilot advises the initial outbound heading is 045°. We reduce speed to 40 knots. At the end of 15 seconds the copilot advises, "Turn left, standard rate to 135°."

Our turn is a little in excess of standard rate. As a result, when our aircraft heading reads 150° our ADF needle is reading zero. This is no problem. We are very close to the station, and any attempt to correct to make good an inbound track of 135° would fail in the first place and is unimportant in the second. In this situation we would home to the station on our heading of 150°. However, upon station passage it is necessary that we establish our outbound track of 135°, plus or minus drift correction.

As I have already mentioned, the approach consists of a letdown during the execution of a standard 90-270° procedure turn. Upon reaching low station altitude, which is 1,000 feet above the ground, the aircraft is turned to the reciprocal of the approach heading. In the example used above the low station outbound heading would be 180°. Ten seconds after passing low station outbound, a standard 90-270° descending approach procedure turn is effected. The recommended rate of descent is 400 fpm, speed 40 knots (see fig. 4).

Figure 4. The dotted green line between the station and arrow A is 10 seconds long. The solid green line between arrow A and arrow B is 2 minutes in length. The altitude of the aircraft above the ground at arrow A is 1,000 feet and the airspeed is 40 knots. Upon starting procedure turn, a 400 fpm rate of descent is established. When reaching arrow B the aircraft altitude is 200 feet with the station directly on the nose. As in the case of the figure eight letdown pattern, track from arrow B to the station is unimportant. If the aircraft heading is within 30° left or right of the desired approach heading, homing is acceptable. If ground contact is not established upon reaching arrow B, airspeed can be further reduced and the letdown continued at a slower rate.



The approach I have described can best be called a "terminal" ADF. Just as in the case of a TVOR approach, the object of the game is to make ground contact short of the station. In the event contact is not made, the missed approach is effected upon reaching the station.

The missed approach procedure may vary with beacon locations; however, most missed approaches will consist of tracking from the station on the approach heading while climbing 1,000 fpm at 40 knots until reaching safe terrain clearance altitude.

I realize a procedure such as I have described fractures most of the regulations by which we are trained and required to fly. For the safety officer I can only say that this system has been repeatedly flown by persons under the hood who are not helicopter instrument rated. As a result, headings, speeds, letdown and turn rates were erratic. Even so, at no time did the approach attempt fail, or was it necessary for the IP to take the aircraft.

An area which should be investigated is that involving helicopter instrument formation flying. I have no experience in this area and feel that an aviation unit should be selected and given special authorization to determine the feasibility of such procedures.

I have used the AN/GRN-6 for my approach beacon only because it is available in the field today. I do not suggest the AN/GRN-6 is a desirable beacon; it is much too large for our purpose. In addition, the need to dispatch the beacon to the landing area would be very time consuming and I'm sure in many instances impossible.

We may, in the near future, expect our present AN/ARC-44 aircraft radios to be replaced with the AN/ARC-54 radio. Among other desirable features the ARC-54 is equipped with a visual homing indicator which operates and is used in much the same way as our present VOR equipment. In effect this means every FM radio in the field will soon become a potential approach beacon. This will eliminate the present need to dispatch our approach beacon to the intended landing area, but it will require supported, non-aviation people to become familiar with the procedures of locating and operating an approach facility.

For this reason I suggest concerned Army service schools include in their curriculums the procedure to be followed in site selection, ground reconnaissance, weather estimates, etc. In addition, I suggest the Army Aviation School include as a part of all helicopter instrument training a tactical helicopter instrument support procedure.

In the period between now and the time the ARC-54 becomes available I recommend the AN/GRN-6 beacon be used for training purposes.

The advantages to be gained by training our people in the use of an acceptable tactical helicopter instrument support procedure are many. Not only will we be capable of providing support to the field commander during periods of adverse weather which now grounds us, but in addition we will be able to use weather as a means of concealment by deliberately flying IFR.

For years the Navy has made excellent use of weather as a means of concealment. There appears to be little reason why we in Army Aviation cannot make equally good use of weather in the battle area.

In fact, we may one day come to look upon the absence of weather with something akin to the dismay the presence of weather generates today. ☆

How's That Again?

CAN A MOJAVE carry a Beaver internally, or must it be done with a sling? Which method is safer?

These questions, sounding like something from *The Leatherstocking Tales,* were answered last summer by an Army Aviation Unit Transportation Company in the Republic of Vietnam.

Called upon to airlift a Vietnamese Air Force U-6A Beaver from Tay Ninh to Bien Hoa, the unit, employing a CH-37 Mojave helicopter, expected the usual sling operation. But when they saw the extent to which the aircraft had been dismantled, their plans were suddenly changed. The Vietnamese airmen had removed the wings, main landing gear, tailwheel, vertical and horizontal stabilizers, rudder and elevators.

Instead of slinging the Beaver, the crew of the Mojave decided it would be safer to load the entire ship inside. Slingloads normally require reduced airspeeds and altitude, making an air recovery crew a low, slow target when over Viet Cong territory.

After an hour of pushing and sweating, they had the entire Beaver in the belly of the Mojave and 90 minutes after that, the U-6 was on the ground in Bien Hoa.

—*The Observer, June 6, 1964*

Ideals and Realities

Captain George F. Christensen

ARMY AVIATION is approaching its "moment of truth." It's time to examine ourselves, in terms of capabilities versus our zeal to perform any mission. We must identify our ideals and realities.

Military and civilian leaders are watching our progress with intense interest. Money spent on such projects as the Howze Board, 11th Air Assault Division(T), and the concentration of Army aircraft in Vietnam give testimony to this fact. We have done much in these areas to develop needed doctrine for the employment of our resources. So far we have attained a satisfactory rating. We are justifiably proud of our accomplishments. To maintain a satisfactory rating using new equipment and doctrine, we must not let our ideals blind us to realities.

One reality we must consider is that Army Aviation is out of the Operation Grasshopper stage. New equipment requires that we be not only pilots but highly skilled technicians, capable of effectively utilizing a million dollar aircraft and the complicated gear it carries.

This requires more "sophisticated" Army Aviators, but if you show me a captain who is dual rated, twin-engine qualified, dual instrument rated with one or two green cards, cargo helicopter rated, tandem rotor, multiengine helicopter, OV-1 rated, armed helicopter qualified, and an instrument examiner, I'll show you a real likely passover on the next promotion list because he isn't branch qualified.

How could such a "goof-off" expect to be promoted with his contemporaries who know about "cannon cocking," going "high diddle diddle, right down the middle," or how to build a Bailey bridge. The career people tell us that those are the important things. Being an aviator is a part-time job.

Ideally we want to be well trained in both areas; in reality, I say it can't be done. If we expand our capabilities with new hardware and develop doctrine to include bigger and better accomplishments and capabilities in Army Aviation (for instance formation helicopter flights under IFR conditions to field letdown facilities in enemy held terrain), the demands on the aviator will increase immensely, and successful accomplishment of the task will depend on the skill of the individual. This skill cannot be attained or retained as a sideline, and it is unrealistic to even suppose that it could.

Another reality we must face is equipment, or should I say lack of equipment generally, in the hands of a unit. Major General Clifton F. von Kann in his article on helicopter instrument

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flying in the May 1964 issue of the U. S. ARMY AVIATION DIGEST stated, in regard to the capability of flying our helicopters in and out of weather (an idea that urgently needs development and a book written on the subject) that despite all that has been said, satisfactory equipment and techniques for this type of work have not been developed.

Ideally, we desire reliable, simple, efficient, and inexpensive aircraft and ground equipment that can be effectively used by part-time aviators that we now have in the system. In reality we do not have such equipment.

Imagine for a moment that you have been assigned as a flight leader of the second flight of a formation of twenty CH-34s. It is H—3 hours, the weather is 200 feet overcast, ¾ mile visibility with light rain and fog. The hills to the east are obscured, and the weather is not forecast to improve for the next 6 hours. The ground commander has planned a vertical envelopment using 20 aircraft in two flights to lift a striking force 25 miles deep into enemy-held terrain to the east. (This ground commander had read in the AVIATION DIGEST that this type mission was "no sweat" to Army Aviation.)

Evaluate yourself and make the decision that you are well qualified and ready to go. (Just play along a while.) Now, drive to the aircraft and check your equipment. Take a walk down the flight line and look over the 10 aircraft in your flight. The discrepancies range from "compass swing over due," "J-8 precesses excessively," "clock missing," "ADF inop," "VOR flight check over due," "FM radio inop," to "A/C restricted to local pattern for 10 hours."

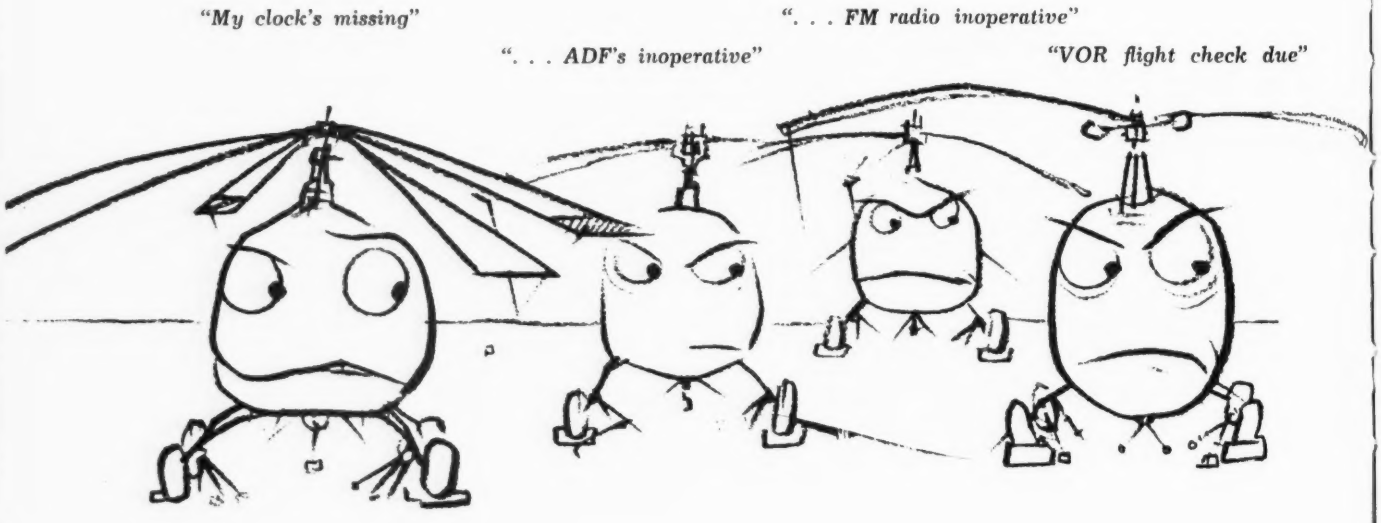
(The maintenance officer in our hypothetical situation says those things would have been taken care of except he is only 62 percent strength. He has no scheduled inputs of trained personnel.)

If you now decide that you are still ready to go and can safely accomplish the mission with the aircraft you have, how will you let down at the destination? As of now, no suitable means exists. Let's place the cart behind the horse and properly equip ourselves with aviators and hardware before developing doctrine for something we don't have.

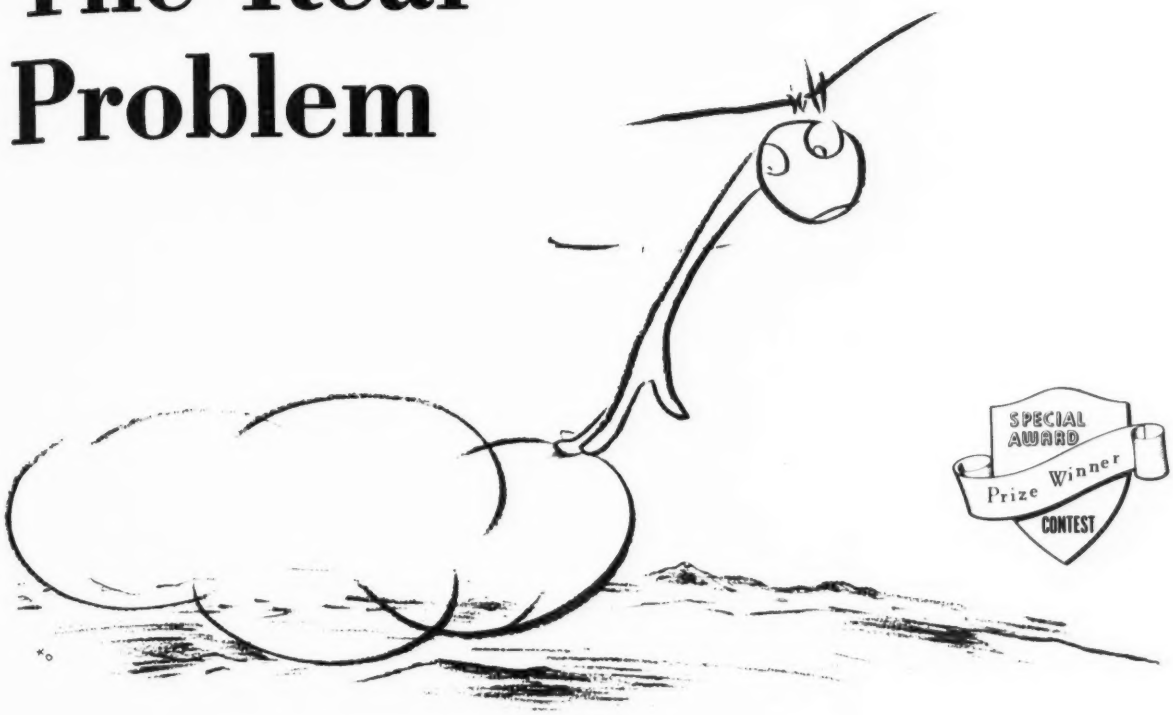
Ideally we want to accomplish this type of mission, but in reality we can't. We waited for the helicopter to be developed before vertical takeoffs were doctrine, so why not develop the equipment necessary for this type flight profile before we attempt it? We need only to watch some old movies of the foolhardy to see the fate of those who attempted to "fly to the moon" before they discovered, generally the hard way, that they just didn't have the equipment at that time.

A wise man once said, "All the easy things have already been done; we inherit only the difficult ones." Let's accept the challenge, but difficult tasks need not be accomplished the hard way. Let's not oversell our product.

If we in aviation attempt to force upon ourselves these ideals we would like to see become doctrine without fully considering the realities as they exist, we have much more to lose, in terms of lives, prestige, mission accomplishments, and the ability to be fully responsive to the ground commander to do what we say we can do, than we could ever hope to gain. ☆



The Real Problem



Major Richard A. Humes

HELICOPTER instrument flying has been a reality for some 10 years now. It has progressed from the isolated experiments of some rather courageous aviators at the Army Aviation School to the point of a practical and rather routine operation in all parts of the world. Techniques and procedures necessary for flight along established air routes are well developed, but success depends only upon flying the helicopter as a slow airplane. I submit that the real problem is the tactical exploitation of the helicopter in submarginal weather.

Eighty-knot helicopters proceeding on ATC clearances along V-241 at 10-minute intervals will eventually transport a lot of people from Fort Rucker to Fort Benning. But this operation can be conducted far more effectively and expeditiously by fixed wing aircraft of equivalent capacity.

The inherent qualities of rotary wing aircraft, such as slow flight and vertical landing, which render them indispensable in tactical operations are not used in instrument operations today. In fact, these same qualities lead to direct or related disadvantages as compared to equivalent utility or transport airplanes.

The effective tactical employment of helicopters is based on their ability to deliver rapidly an effective combat mass to any point on the battlefield, independent of terrain obstacles or intervening enemy ground forces, with the shock action inherent in vertical envelopments. This tactical doctrine precludes advance preparation of airstrips or landing aids in the objective area and requires a mass helicopter assault on the objective.

This doctrine and the techniques to exploit it have been thoroughly developed by the 11th Air Assault Division(T) and forces in the Republic of Vietnam. But because we lack a means to safely conduct mass instrument flight, or vertical or near-vertical instrument land-

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ings, these operations are severely limited by the existence of submarginal weather conditions at either departure or objective area or along the route.

It is probable that a feasible electronic or mechanical system will be developed to permit a mass, all-weather vertical envelopment. Such a requirement has existed for several years. It is safe to assume that several more years will pass before assault helicopters will be universally equipped with such a system.

The immediate solution is to use the ability and equipment we have NOW by exploiting methods based on aviator technique and skill and existing aviation unit capabilities. We have no time to wait for tomorrow's devices in the light of today's requirements. We can do this with present equipment.

Envision a mission requirement to attack and destroy a known enemy force operating 50-75 miles in front of an airmobile task force. Aerial reconnaissance has located enemy headquarters and furnished the task force commander with the location of several suitable landing zones. Intelligence indicates that the enemy intends to disperse after darkness tonight. Weather in the task force laager area is 300 - 400-foot ceiling and ½ - 1 mile visibility and deteriorating. Objective area weather is the same, with no change forecast for the next 24 hours.

The first 40 miles of terrain in the direction of the enemy is rolling and hilly with general zero-zero conditions along the route. Terrain in the objective area is generally flat with some marsh areas. Task force patrols are operating near the enemy. Today this operation could not proceed. One month from today an aviation unit trained to accomplish this mission could be available.

A mission to attack and destroy the enemy by vertical envelopment is preceded by intensive instrument training in the classroom and aircraft

This unit would assemble in the laager area after a thorough briefing on the mission and assignment of formation numbers. The pathfinder patrol would be instructed to execute a preplanned guidance operation. The unit would then commence a departure sequence according to the rehearsed unit SOP.

An example of a type SOP might be as follows: the briefing includes a basic altitude which will provide safe en route terrain clearance designated as altitude ALPHA. Higher altitudes at 500-foot intervals are designated BRAVO, CHARLIE, DELTA, and FOXTROT.

The Army Air Traffic Company will safeguard this corridor of airspace from all other traffic during the operation. The pathfinder patrol will establish a navigation fix and an air-ground communication facility 10 - 15 miles from the objective area, verify obstacle clearances and actual weather, and report ready. A unit SOP cruise speed is designated; for example, 80 knots.

Aircraft will depart by numbers at 1-minute intervals, according to established standard unit departure procedures. As an example, aircraft number 1 will depart on en route heading, climbing to altitude ALPHA. Aircraft number 2 will depart 45° *right* of en route heading, climbing to altitude BRAVO before proceeding en route. Number 3 will depart 45° *left* of en route heading, climbing to alti-

tude CHARLIE before proceeding en route. Aircraft numbers 4 and 5 will depart 90° right and left and utilize altitudes DELTA and FOXTROT in the same manner. Number 6 will proceed as aircraft number 1, repeating the five-aircraft cycle.

Upon arrival over the objective fix, aircraft number 1 will descend to VFR on the en route heading at cruise speed, slowing to minimum speed (20-25 knots) immediately upon becoming contact. Number 2 will turn to departure heading (45° right) and descend to contact, *then* turn left and join up on number 1. Aircraft number 3 will turn 45° left of departure heading and descend to contact, then turn right and join up. All succeeding aircraft will follow similar procedures.

Properly executed, this will result in IFR flight under conditions of 500 feet — 5 minutes separation — with resumption of an assault formation approximately 7 miles from the objective fix (considering one assault company employing 15 aircraft).

Nothing is required to use these methods today except training, and training in this, as in any operation, is the key to success. Aviators must be trained in instrument flight, with extra emphasis on ability to maintain precise heading, airspeed, altitude, and flight discipline.

The pathfinder patrol must be trained in approach zone selection and evaluation, and in weather observation and navaid utilization. The combined assault team must be trained in these methods *as a unit* to ensure precise departure intervals, standard maneuvers, rapid joinup, etc. Above all, this training must develop confidence between various aviators and between aviation elements and pathfinders.

These techniques will not enable Army Aviation to meet the requirement for *all*-weather helicopter assault, but they should serve to accomplish 90 percent of the requirement. The last 10 percent will have to wait for technological development.

The method described here is untried. The examples of specific techniques and procedures are simply to illustrate a way in which this might be done. Training and experimentation with an aviation company is required to develop and refine specific techniques and to actually test these methods.

Our present training methods tend to stop with the development of aviators qualified to fly civil airways administratively, but give little thought to all-weather combat tactics. If our aviation training cannot be applied to meet a tactical requirement, it is not necessary training. We need tactical helicopter assault training in all-weather conditions, and it can be done.

The real problem in rotary wing instrument flight is the tactical exploitation of the helicopter as an all-weather VTOL aerial vehicle, rather than increased use as a slow, short-range airplane. Let's start now to solve this problem today. ☆

Aviators in formation flying must be able to maintain precise headings, airspeeds, altitudes, etc.

Copter Instruments Tactical and Practical

Major Nelson E. Luce

FORMATION FLYING in the clouds? You're out of your mind, friend!"

This is the usual attitude when we present the problem of moving several helicopters simultaneously through the clouds in a standard formation. We have to revise our concept of the word *formation* to move several helicopters through weather simultaneously. But it can be done with a reasonable degree of safety with presently available equipment.

Weather can be turned into a distinct screening agent and be considered an advantage in military air operations.

The flexibility of our equipment can meet the requirements of several type missions:

Point A to point B with letdown facilities under control of friendly forces.

Point A to point B behind enemy lines with pathfinder teams in advance.

Point A to an established and identifiable rendezvous point behind enemy lines, pilotage by dead reckoning to objective, and return to point A under IFR conditions from the objective.

In all three types of missions we would limit our formation to five aircraft. If we require more than one group of five aircraft to accomplish the mission, we must establish a different return route (airway, if you wish) and allow a safe interval between groups of five.

We assume that our takeoff area will be under friendly control and developed so we can

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clear known obstacles before entering IFR conditions. Runways, as such, are not necessary for helicopter operations. With extreme mobility and flexibility we could consider our airfield capable of moving to another suitable field while we are on a mission.

We hope the airfield CO has consideration enough to provide an operational AN/GRN-6, AN/FPN-33 or AN/TPN-8 at the new site before he terminates service at the old one if IFR formations are in the air. A casual prearranged code word would be a nice-to-have luxury for those of us in the clouds.

IFR helicopter formations haven't developed to a point of proficiency where we call ourselves the Blue Angels, but we can suggest a workable beginning. For five aircraft in trail we suggest a 2-minute interval between helicopters. The flight leader flies the lead aircraft and reports leaving 2,000 feet on climbout to either VFR on top or to 5,000 feet. Number 2 ship takes off at a 2-minute interval, reporting passing 2,000 feet on climbout to 4,500 feet. After a 2-minute interval, Number 3 climbs to 4,000, Number 4 climbs to 3,500 and Number 5 climbs to 3,000.

In the event the flight leader ascertains a VFR on top is available, he can order each sortie up in order. In case it is IFR all the way, the flight leader proceeds to his letdown facility and holds. The flight will land in reverse order.

Number 5, as low man in the stack, reports breakout altitude or missed approach with a prearranged break to return to altitude on top of the stack. Assuming the ceiling allows a normal breakout (we suggest 500 feet above known obstacles), when the flight leader lands all his ducks should be waiting in a row. This technique is particularly effective when beacon AN/GRN-6 is on the letdown end of the flight. Our formation places five aircraft at the objective, landing in a 10-minute time block or less. We have allowed only 500 feet vertical separation intentionally because of demonstrated proficiency of student instrument pilots. All mandatory reports are in accordance with ATC procedures. All aviators monitoring will be aware of the others' intentions.

If we have the luxury of adding radar observation with the AN/FPN-33 or the AN/TPN-8, we use the same technique of the flight leader going up first, coming down last. The radar operator directs the flight to the vicinity of an established terrain feature for letdown, i.e., river, highway, railroad, or mountain peak. As each aircraft breaks out the pilot must establish ASAP dead reckoning pilotage and visual contact with other aircraft ahead.

We suggest that as each helicopter breaks out we reduce airspeed until the flight leader closes and the rendezvous is completed. Proceed VFR to objective. With limited ground time we can return to our home base by flying IFR from the objective on a general heading, plus or minus 10°, towards home.

Our friendly radar operator controls our approach with appropriate directions. We hope he speaks English. Our flight leader climbs to 5,000 and prays for enough fuel to come down last. After monitoring the safe arrival of the four others below him, he

is justly proud of a functioning team.

A single file of five helicopters doesn't sound like much, but it would require ten extremely proficient instrument rated helicopter pilots and a minimum of two equally proficient ground controllers. We might like to have a couple of dependable repairmen around for our avionic equipment. They're almost as important as the cook that keeps the coffee perked.

LOST COMMUNICATIONS & EMERGENCY PROCEDURES

Our experience dictates that lost communications is to be expected as routine. What to do when we experience lost communications must be planned in as much detail as the flight plan itself. In IFR helicopter formation tactics, before takeoff we designate an ETA for each aircraft by number that reserves the final letdown facility for 15 minutes for an approach without communications. This is one of the considerations that limits our suggested flight to five aircraft.

Before descending to approach altitude we designate a right turn *off* our *airway* for even-numbered aircraft and a left turn off the airway for the odd-numbered helicopters. Distressed aircraft fly at a 90° angle to the planned flight path for 2 minutes before initiating descent. This allows the remaining ships to continue the mission without having an aircraft in distress dropping through their altitude on their flight path. If two odd-numbered ships are out of communications simultaneously, we depend on constant airspeed to provide 4-minute separation along the airway designated for return under emergency conditions. ☆

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We All Like Cookies, But . . .

Major Robert L. Hill

THE DEGREE of self-discipline an individual has attained is perhaps the only valid yardstick of his maturity.

Each of us once knew a child who would furtively raid the cookie jar when alone in the kitchen, but resist the impulse when his mother was watching. This example shows that a child's behavior is greatly determined by external pressures. As this child grew older, he absorbed many rules of social behavior and learned to resist temptation. By high school age he had earned the right to handle money, and to use the family car, by demonstrating the level of maturity and self-control his father required. He found that success in school depended directly on the amount of will power he could muster toward sticking with his homework when he would rather watch television or harass the local populace by hot-rodding around town with the gang.

Developing a man-sized, bedrock foundation of self-discipline is a slow and painful process, and a lonely one — for *each man must build his own* out of the materials provided him by his mother, father, church, school and friends.

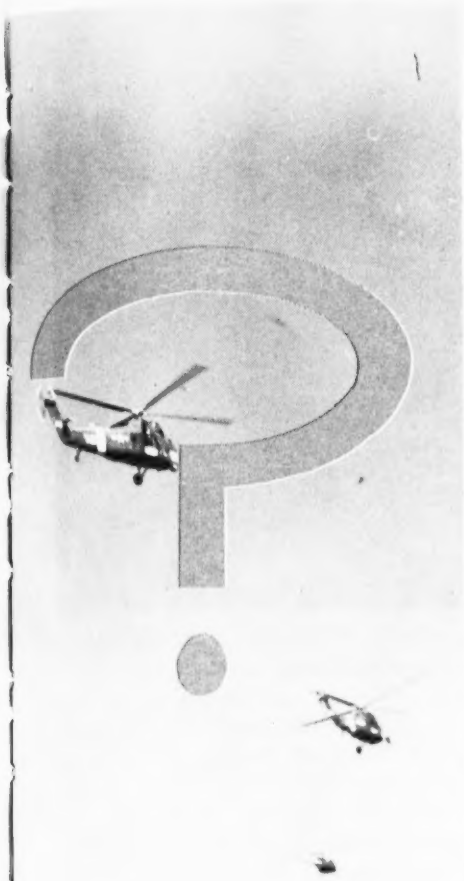
A man may exhibit a certain degree of self-control in the company of his commander, another when surrounded by his friends, and yet a different level when among strangers. I know a man who is afraid to speed past a highway patrol car and ashamed to be a litterbug in his own neighborhood, but when driving without these lawful or social pressures acts like he owns the world. This immature type is still raiding the cookie jar *because no one is looking.*

As officers and pilots you are frequently placed in a situation where you must probe for your own personal level of self-discipline. You may fly with the Standboard, or with your buddies, or perhaps all alone in the airplane. Do you *regress in age*, allow your self-control to *erode away* in direct proportion to the removal of external pressures, or is your compulsion to act as you know you should, deeply imbedded in a solid layer of honesty, maturity, and pride of achievement?

Do not indulge in the luxury of allowing rationalization to excuse your minor defections — the man who parks his car improperly or skips a haircut is the same man who will skip a preflight or chase jack rabbits on a local transition flight.

Only *you* can fix the level of your maturity. Only *you* can make yourself into the man your mother and father wanted you to be. Only *you* can create within yourself the self-discipline it takes to keep your hand out of the cookie jar when no one is looking.

Reprinted from "Aerospace Safety"



Who Do You Want To Go?

Major Milton P. Cherne

IT WAS DARK and raining when the jeep screeched to a halt in front of the operations shack. The light glowing through the splattered windows was evidence of activity that should have terminated several hours ago. The "old man" sloshed through the puddles to the door and with a shove barged inside to the warmth and dryness of the shelter.

Last minute changes had caused the entire plan for the morning to be extensively modified and it looked as though it would be another all-night session. Higher headquarters just never seemed to realize the magnitude of changing schedules at the last minute. Cooks, vehicle drivers, pilots, and the whole outfit associated with this "well-planned mission" would have to be briefed again to meet the new time schedule.

"Captain," murmured the unshaven and near exhausted commander, "do you have a weather report for the morning?"

"Yes, sir," was the prompt reply. "This stuff should move out of here about three in the morning. By 0500 they are forecasting 2,000 broken, 5,000 overcast. Visibility should be around 4 miles and sunrise is at 0600 hours."

"Well, brace yourself, Captain. We have been rescheduled to land at the pickup area at 0545 hours. The way I figure it, we will have to depart here at 0430 hours. Alert the key people that I want them down here in one hour for another briefing." The CO paused long enough for the operations officer to give the first soldier a call.

"Of course, you know what this does to my crew scheduling, don't you, sir?" came a comment

". . . once we leave . . . we will not have any reference to the ground, even though visibility is good."

Four minutes later, on a dead reckoning heading . . . the copters flew into a sea of darkness

with hidden undertones. "This somekind of messes up what I have been doing for the past hour or so. It looks as though we are going to be doing some tactical instrument flying in the morning and we just do not have enough tickets to go around. The way I see it, once we leave this immediate area, we will not have any reference to the ground, even though the visibility is going to be good. There won't be one single light shining out there in 'no man's land,' and there won't be any light of day until just before we reach the pickup area! Sir, you handed me a real problem."

"Look, Captain," growled the CO, "we have 15 ships scheduled for the mission and we have 15 instrument tickets in the company. It shouldn't be too difficult to figure that one out!"

"You're absolutely right, sir. But if I schedule these four men here," he replied as he pointed to the scheduling board, "I will have to take one man off of sick in quarters and the other three are already high time men for the month. You said that you didn't want anyone to fly more than the hours indicated in the SOP, and they are 20 hours over that already."

You could almost feel the heaviness and tension in the room as both the CO and the operations officer weighed the pros and cons of flying these men in the morning and taking the one off of quarters. With a sigh, the operations officer nodded his head and agreed that he must alert those four men with those four precious instrument tickets. *Now, if he could determine that all 15 ships had working instruments, his problems for the evening would be solved.* Half thinking and half out loud he muttered that if everyone had a ticket, or had the skill to fly instruments, he would not be faced with one more unwanted and unnecessary problem.

At 0430 the next morning the lead aircraft broke ground and climbed slowly to 1,500 feet. The weather forecast had been accurate and he could maintain reference to the dim lights of the airfield until the orbiting flight closed up in formation. Four minutes later, on a dead reckoning heading to the pickup area, the copters flew into a sea of darkness.

After the debriefing that night, the old man asked a few people to remain. When the last of the tired crews had departed, he took out a fresh cigar and gathered these key people around a table.

"What," he asked, "is the answer to our dilemma? This type of flying is going to be the rule rather than the exception. As we go along, we are going to be flying night assaults and numerous night med-evacs. Obviously, this problem of not enough instrument qualified people is going to haunt us again and again. Our local situation is something that we are going to have to live with, but perhaps I

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can drum up some intensive interest in this area through my reports and possibly save future commanders the anxieties that we are facing now."

A graying W-3 stirred in his chair. Slowly and deliberately he removed a well worn pipe stem from his mouth. When he spoke, which was infrequently, he generally had something worthwhile to say. The room quieted down in anticipation of what was coming.

"Major," he drawled, "the way I see it, we are living with the mistakes that were made 8 to 10 years ago. Even when I first got out of flight school I can remember everyone making a big hubbub about instrument flying. You had to have a whole bunch of hours before you could go to instrument school. By the time you had enough hours, you had either broken most of the rules in the book or you had developed a fear of weather flying because everyone made such a fuss about it.

"Admittedly, we have cleaned up this problem for the rigid wing boys, but helicopters were, and are, a horse of a different color. Until I got my ticket in '60, I didn't even have to sweat out hood flying, link and annual minimums. Even when they finally got around to saying that hooded flight was a requirement for rotary wing pilots, the criteria was waived because of the shortage of aircraft flying hours available."

"Chief," interrupted one of the platoon leaders, "if the CO wants to make this a matter of record, I'd like to throw in a few facts that we worked out before we came here. Our average yearly flying time in the States was between 200 and 240 hours per month. The high months were during the division ATT and yearly maneuver. This was governed not by the desire to fly, nor by the number of missions requested, but by the amount of aircraft and spare parts available. Also consider that we had to run our own transition training and we were responsive to 17 different contingency plans. These called for frequent alerts and consumed flight hours.

"Now, assume that we were up to strength with 44 pilots and had to meet just basic minimums. Each man has to get 15 hours of night per year and 20 hours of hood per year. This works out to 35 hours per man, or a total of 1,540 hours of proficiency training per year out of a maximum of 2,880 yearly flight hours. I know that the operations officer tried to integrate training with service missions, but how much hood time can you log on a 20-minute tactical flight?"

"Whoa, Captain," said the CO. "I get the picture that you're trying to present, but this does not help our situation. Regardless of what was wrong in the past, we have to resolve the problem for the future. I, too, remember that we set up a unit instrument school and for five consecutive months diligently tried to award R/W instrument tickets to four people. I am also aware that they still do not have all of the qualifications; nor are they likely to get them here. We are all aware that perhaps due to our support activities, we couldn't hack it. But let's get back to the problem at hand."

Unit training schools are hard put to qualify pilots in all phases of instrument flying

"I've been transitioning that new lieutenant who just got out of flight and instrument school"

The other platoon leader flipped his wrist up to indicate that he had something on his mind. "Sir, as I see it, there are three solutions to our problem. First, we have to increase the proficiency of all aviators to fly tactical instruments. When I say tactical instruments, I mean to fly for reasonably short periods of time without reference to the ground, like we did this morning. We don't have to be fancy and go into holding patterns, interceptions, plotting fixes, estimating ETAs, etc., but we do have to maintain the ability to climb up through the weather, fly straight and level for, say, 10 to 15 minutes, and to be able to follow the instructions of a GCA controller."

The captain chuckled as he continued, "I noticed that no one checked instrument tickets when you led us up through that layer of stratus clouds when we were receiving small arms fire last Tuesday. Anyway, that is the first requirement. As a temporary solution, we can make up hoods and fly instruments when we are on logistical support missions. It's worth thinking about.

"Second, we have to make the Head Shed in DA and at the Aviation School aware of our instrument flying problems, both past, present, and future. Lastly, we need realistic and flexible regulations that will give commanders the prerogative of weighing local considerations and granting waivers if necessary.

"I add that last bit because I was on Boot Strap before I joined the outfit, and when I had to let one of my tickets expire, I was sweating out the so-called disinterested party that would be on the annual flight record review board. Oh, I know that it was legal, but as you well know, I still haven't regained both tickets. I merely swapped one for the other and, well, it just doesn't look good."

"Begging the Major's pardon," the chief twanged, "but I agree with the Captain only up to a point. He's got two tickets to play with and I only have one. When you sent me TDY to maneuver headquarters, I could only fly OHs. Even though my time built up, I was still assigned to the unit and I couldn't have stolen a chopper with instruments for proficiency purposes. But, I s'pose that's neither here nor there.

"One thing the Captain didn't mention was responsibility for training. I honestly don't think the unit is the place to teach a man regulations, procedures, and all of that ground school business, much less use critical flying hours for instrument training. Too expensive, too. The way I see it, DA should keep close tabs on the new aviator in particular. Get him out of flight school first. Let him build up, say, 200 or 300 hours and then whip him back for instruments. Let those going overseas have first priority, but don't let anyone out of the States without a ticket.

"Now you may wonder why I'm set on this procedure. Well, I've been transitioning that new lieutenant who just got out of flight and instrument school. He's a fine boy and is going to make a good Army Aviator one of these days. But I'll be switched if he doesn't spend more time inside the cockpit looking at instruments than he does swiveling his head around looking for people who might kill him. Most of our type flying is VFR, and first of all, I want a good VFR pilot. Second, one who can take care of himself on limited instruments, and last, a finished product who is a master of both.

You know, Major, someone like me."

This last remark eased the seriousness of the conversation and, as always, humor had the effect of stimulating the conversation. We all realized that the chief was, in fact, chiding us on our desires to have every man who joined the unit to have at least 3,000 hours of helicopter time, be the holder of a special ticket, and be able to read a map like a G-2 interpreter.

"Well, let's see if I can join together your various ideas," the major cautiously said as he ground out the butt of his cigar. Hopefully he awaited additional comments, although what the group had proposed was in line with his thinking. Walking to the broken blackboard he started to list what they thought was needed. "First," he said, "we must keep in mind that we must be responsive to the needs of the ground commander. Responsive and responsible. This means we must be able to respond as often, and more often, as can his ground transportation. We must have a marginal, or tactical, or call it what you will, instrument flight capability.

"We need reliable, accurate presentations of aircraft attitude. Basic instruments and supporting instruments, radios, etc., should be engineered into the helicopter in direct relation to the mission of the machine.

"We need, in this priority, skilled VFR aviators, skilled VFR with tactical instrument abilities, and skilled VFR and IFR (FAA) pilots.

"Personnel management and the Aviation Center should work out a program to progressively train instrument rated people. A building block skill level is recommended to add incentive to the program.

"ARs should be reviewed to grant commanders greater flexibility in waiving instrument requirements based on local conditions which may preclude even the most adamant individual from meeting current requirements.

"A special refresher training course should be available at the Aviation Center for those officers who need assistance beyond the capabilities of immediate local resources. They . . .

"Answer the phone, Captain," the now bleary-eyed major ordered.

"Yes, sir . . . . Yes, sir. Two miles due north of this morning's landing site No. 1. Coordinates 8375, 2162. Yes, sir; yes, sir; in about an hour and a half. Yes, sir!"

"Major," the operations officer chimed, "we got eight seriously wounded men just north of site 1, 300-foot ceiling en route with clear skies at their location. They'll light bonfires in an hour and a half . . . . Who do you want to go?" ☆

"They'll light bonfires in an hour and a half . . . Who do you want to go?"

Helicopter Tactical Employment

CWO Rex Flohr

BY THE VERY nature of helicopter flight characteristics, it could be assumed that they could best be deployed in a tactical situation under instrument or near instrument flight conditions. The capability of modern helicopters to ascend and descend at very steep angles and to fly at very slow airspeeds in marginal weather would make them virtually safe from hostile aircraft. If it were possible for helicopters to actually fly at low altitudes within a cloud cover, they would be relatively safe from conventional enemy ground weapons.

To make this possible, extensive pilot training, flight testing, and aircraft instrumentation would have to be undertaken by Army Aviation.

The first and immediate problem is pilot training. Of the many helicopter instrument pilots now available, only a handful are even near the

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proficiency level they had attained on the day that they received their initial instrument flight check.

Numerous directives are continually sent to units directing that instrument pilots maintain a high degree of instrument proficiency. Yet, no workable solution has ever been offered as to just how these pilots are to maintain this high state of instrument proficiency.

The sad truth is that the majority of the Army's instrument pilots are given a few hours of desperate training just before their ticket renewal birthday. Then they are given an instrument flight check that leaves the examiner scratching his head and searching his conscience. Normally, the individual is able to renew his rusty ticket and is immediately sent back to the flight line greatly relaxed. Again he is assigned VFR missions for the next year, with little or no chance to improve or even maintain the small degree of proficiency which he displayed on his annual check.

It is easy to point the finger at the unit commander and say that it is his responsibility to ensure that his aviators are given ample opportunity to maintain proficiency. This becomes most difficult for the unit commander, as he normally has no operational control of assigned aircraft. In the normal operation of an aviation company, the operations officer at a given hour advises a higher headquarters of the number of flyable aircraft that will be available the following day. At another given hour the higher headquarters advises the operations officer of just how those flyable aircraft will be used the following day. It would be rare indeed if just one flyable were ever left to be used solely for pilot training.

In this respect it would appear that pilot training within an operational unit has become secondary to the training that tactical troops receive from the use of aircraft. It should be noted that tactical troop units have both a peacetime and a wartime mission, the peacetime mission being to *train* for their wartime mission. The mission of Army Aviation is nearly the same in both peacetime and wartime, primarily troop haul and resupply, and the more technical training of the pilot has taken a back seat.

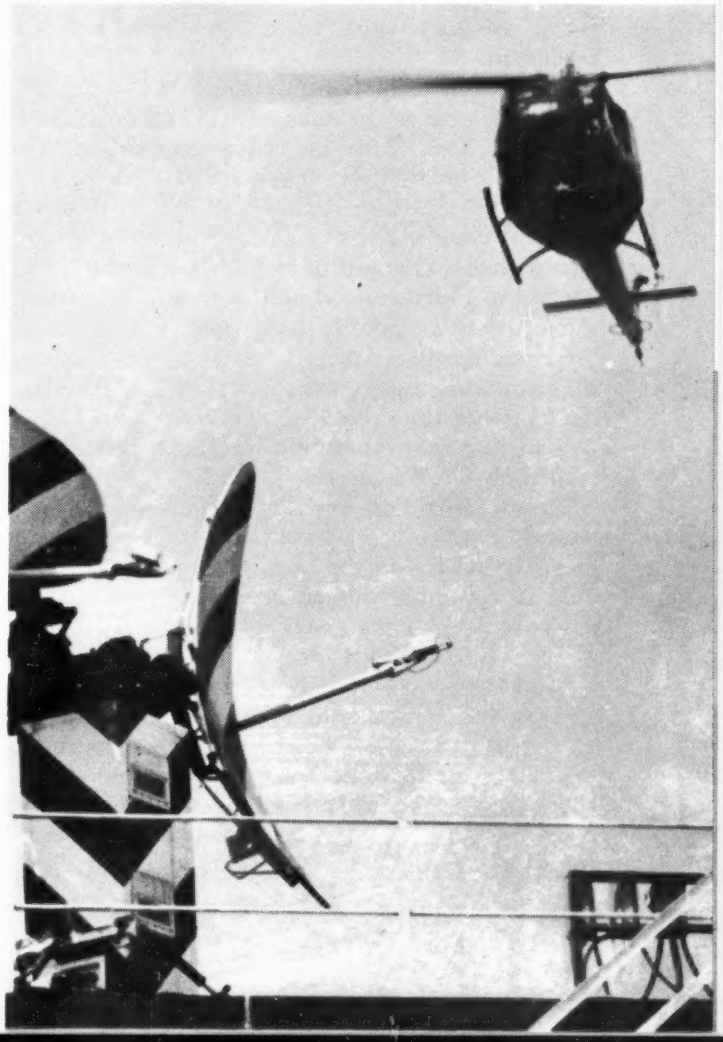
As a solution to this problem, the unit commander should be given complete operational control of 20 percent of his aircraft for use in maintaining and increasing pilot proficiency. With the new policy of every helicopter pilot being instrument rated, the unit commander's problems of proficiency training will rapidly become acute. It is possible that he will require *more* than 20 percent of his aircraft to be used merely in maintaining annual instrument minimums for assigned pilots.

In the event all-weather capabilities are achieved for helicopters, then training and minimums can be obtained during tactical helicopter missions, but at present no more than one part of 1 percent of helicopter missions requires instrument flight. It would be safe to assume that more than 50 percent of qualified helicopter instrument pilots have *never* flown an assigned mission under instrument conditions.

Assuming that operational helicopter instrument pilots were very well qualified to perform helicopter instrument missions, the next problem would be to take off and reach a tactical destination without landing facilities.

During World War II bomber type aircraft took off and flew formation flights in clouds even

Maintaining instrument proficiency throughout the year is a problem that has been solved by only a handful of Army Aviators



Missions were accomplished in World War II and Korea by transport and bomber-type aircraft even though all pilots flying in the formations were not instrument rated. Station keeping was maintained by keeping other aircraft in sight.

though all aviators were not instrument rated. By flying in close formation, each aircraft remained within sight of the other and used other aircraft for attitude reference. Naturally, this task would be much more difficult in rotary wing aircraft; however, the possibility does exist, if all aviators were instrument qualified and proficient.

This seems to be the only solution if a flight of helicopters were to take off at approximately the same time with the same destination. The question immediately arises as to just what is the visibility within a cloud or within different types of clouds. For the answer to this question, two helicopters could be dispatched under radar control of Cairns into clouds in a close formation. Each aircraft should have two well qualified instrument pilots aboard, with a preconceived plan for separation in the event of loss of visual contact with each other. Cairns radar could assist in ensuring safe separation in this respect and in returning the helicopters to the field.

These flight tests should be conducted over a period of time so that all types of safe clouds could be tested. In the event visual contact were difficult or impossible in clouds, tests should be made with high intensity lights mounted on the aircraft. These lights would be similar to those used at the approach ends of large runways. They are capable of penetrating up to 300 feet of fog.

If two helicopters succeed in completing a formation flight in a cloud layer, helicopters should be added one at a time to the flight for further testing. A plan would have to be perfected for safe separation in the event of loss of visual contact by one or more helicopters in the flight. This plan could be quite simple, with a rapid change in altitude and subsequent heading change.

Again assuming that IFR formation flight had been found feasible in helicopters, a safe altitude above the terrain would have to be maintained. This altitude could be determined by a thorough map study of the route of flight and by equipping each aircraft with an absolute altimeter. This type altimeter has been used by the U. S. Navy for a number of years. With absolute altimeters, a 300-foot clearance of the highest obstacles would be sufficient.

The Federal Aviation Agency has been experimenting with helicopter radar, which measures both vertical clearance and horizontal clearance with an accuracy to within 50 feet. The results of these tests should be obtained by the Army. If found desirable and usable, a ground clearance of much less than 300 feet could be accomplished even in uneven terrain. With this system, it was hoped that a helicopter could fly to within 50 feet of a hill and then climb over the hill successfully while remaining IFR. The object of the FAA tests was to land a commercial helicopter on a rooftop with near zero, zero flight conditions.

Next, the aircraft would have to be equipped with some sort of distance measuring equipment to measure the distance from takeoff point so a drop zone could be located. This would be used in conjunction with either radar or radio bearing assistance to correct winddrift. A strong radio beam would be the most successful due to low altitudes which would make radar coverage im-

Our lack of knowledge of helicopter tactical capabilities is due to nonexistence of an effective flight testing program — not the capability of the helicopter.

possible for a distance of more than a few miles. This type equipment is probably available and in the military inventory. Navy helicopters have been equipped with DME for some time.

The last problem involved is the most complicated and will require equipment not now available to the services. This is the problem of a successful descent through IFR conditions at the landing zone, without ground assistance. A safe landing into an unknown area would require near vertical descent at a very slow rate. At the present time instrumentation in helicopters becomes ineffective rapidly as indicated airspeed falls below 40 knots. A descent with an airspeed of much less than 40 knots would be required until VFR conditions are reached.

Forward airspeed could be immediately fatal in the event the helicopter struck an unseen object. With this near vertical descent more power would be required, so with present equipment payloads would have to be reduced. In the future, improved powerplants will eliminate this obstacle in military helicopters.

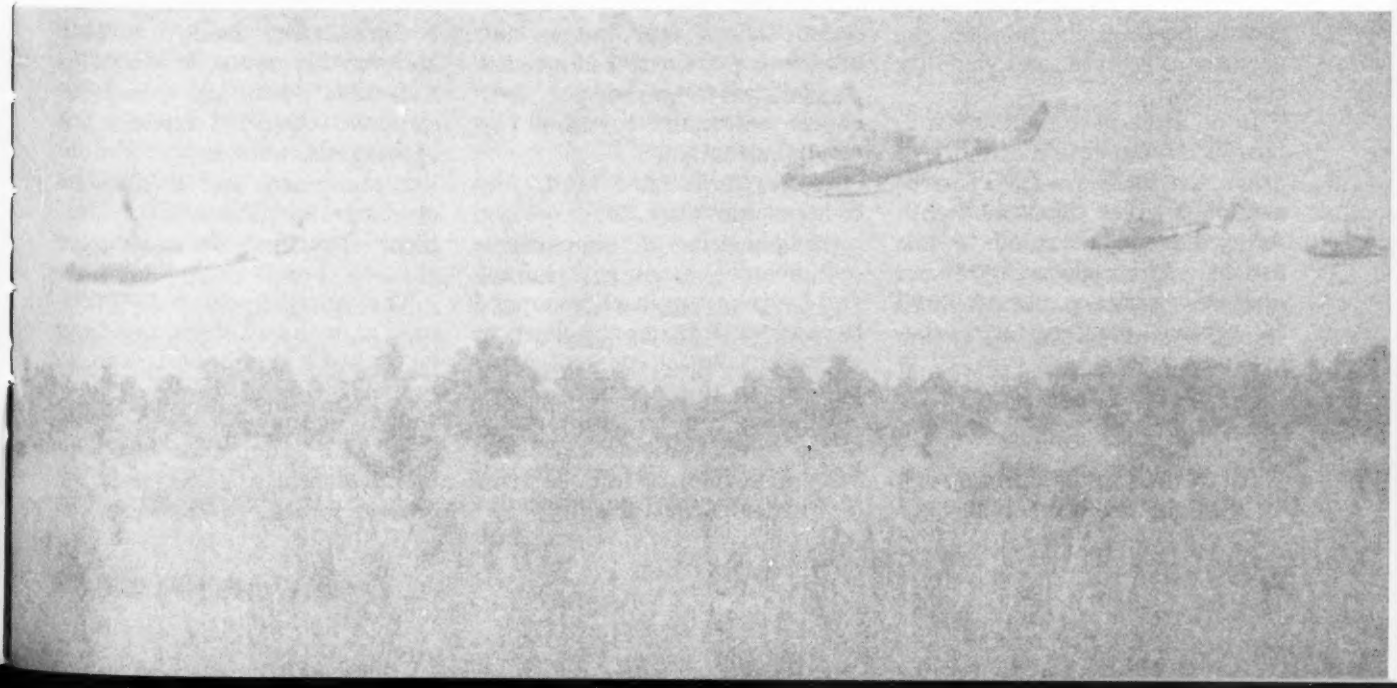
New instruments would have to be perfected for accuracy and aircraft control in the descent. This could be through a gyro system coupled with automatic stabilization equipment. This type equipment would probably be of the type used to guide missiles in vertical ascents. The accuracy required may prove too costly for the program at this time. This type equipment would be required only if the drop zone were to have an unusually low ceiling.

If the ceiling at the drop site could be predicted to be 500 feet or more and the terrain were fairly even, a slow descent to a reasonably safe altitude could be made with present-day equipment with an absolute altimeter installed. Ceilings of less than 500 feet are more the exception than the rule in any geographic area.

Due to the desirable terrain, tests of this nature could be safely conducted south of Fort Rucker in marginal weather, and descents should be tested in conjunction with IFR instrument formation flights.

Our present lack of knowledge with respect to helicopter instrument tactical capabilities is due to the absence of an effective flight testing program. It is not due to a lack of capability of the helicopter itself. ☆

The use of high intensity lights mounted on helicopters, addition of an absolute altimeter, and the use of helicopter radar with 50-foot accuracy are possible solutions to formation flying in instrument conditions



Helicopter Instrument Flight

Eighth U. S. Army Aviation Section

THE IMPORTANCE of improving the helicopter instrument flight program is easily recognized in Korea where operations, training and even survival of ground forces may depend upon the ability of Army Aviation to perform the mission, regardless of weather and visibility conditions.

In an attempt to lend our support to the expansion of the program, the most qualified instrument helicopter pilots in Eighth Army have contributed to this article. Although we are not long on experience, nor prepared to present startling new discoveries, we do hope this article will be of some value in identifying problem areas and defining requirements.

All of the problem areas, such as vertigo, drowsiness and fatigue, encountered during helicopter instrument flight can be attributed to one cause factor — the lack of experience and training. We already have the aircraft and equipment that will allow us to fly safely during instrument conditions, but we have not developed the techniques and procedures required for helicopter instrument operation in a tactical situation.

These techniques and procedures can only be developed by emphasizing the importance of helicopter instrument training and by requiring each command to conduct instrument helicopter operations within present capabilities. In this manner, experience data can be accumulated under controlled conditions that can be developed into doctrine for tactical operations.

Before proceeding further, let us first identify type operations that can be conducted with present equipment. We are currently able to conduct an instrument flight with a single aircraft from point A to B, providing we have a navigational facility at both ends of our route. It would be a decided advantage if each instrument equipped aircraft had operational automatic stabilization equipment and an absolute altimeter, but successful instrument flight can be conducted without them.

The navigational aids to be used at each end of the route can be existing equipment such as the AN/GRN-6 beacon, lightweight equipment being developed, or an adaptation of equipment presently being used by ground forces. In any case, the

With present equipment it is not feasible to move formations of aircraft into enemy territory under near zero-zero conditions

navigational aid must be established and operated in an area occupied by friendly forces.

We can dispatch several aircraft over the same route by providing a time interval between aircraft. The length of this time interval is a factor that must be explored, as a constant rate of speed may be difficult to maintain because both pitch and attitude changes alter airspeed in a helicopter.

With the capability of conducting instrument helicopter flight from point A to B with a single aircraft or multiple aircraft with time interval spacing, we feel that most of the aviation tactical operation requirements can be effectively accomplished. These are to provide administrative and logistical support, displace aviation units to new locations, evacuate wounded from isolated units, and support the administrative move of tactical troop units.

It is not feasible, however, with present or projected equipment, to attempt tactical troop movement into enemy territory when several aircraft must arrive at the landing zone simultaneously. This classical airmobile operation would require formation flight under instrument conditions which cannot be conducted with any degree of safety until each aircraft is equipped with a radar set that will provide a graphic portrayal of the relative position of all aircraft in the formation, or some other system that will ensure adequate separation during formation flight.

The cost of such a system and the probable weight penalty involved tend to preclude procurement if compared with the dubious advantage of conducting airmobile operations during instrument conditions. The development of an airmobile capability under instrument conditions is not considered essential to successful combat operations for the following reasons:

- Airmobile operations are seldom conducted when weather conditions preclude the use of tactical air support to suppress enemy ground-to-air fire and to neutralize enemy armor and artillery in the objective area.
- Although a flight of aircraft in clouds could not be visually observed by the enemy, it would

be a lucrative target for any radar-guided air defense artillery located in the area.

• Regardless of the system used, some sort of instrument letdown must be provided near the objective. An instrument letdown by several aircraft will take time and therefore alert the enemy to the impending attack.

• Through training and proper preparation, airmobile operations can be conducted using nap-of-the-earth flight techniques during all but the most severe weather conditions.

An evaluation of the few reported attempts to maintain visual contact between aircraft while in instrument conditions, with present equipment, indicates that only under ideal conditions can contact be visually maintained, and even then it is extremely difficult.

We, therefore, conclude that helicopter instrument flight is required and is feasible with present equipment with the only limitation being formation flight. Our problem now is to determine how to gain the experience and nucleus of trained personnel required for tactical operations.

The first step has already been taken at the Aviation School. Every rotary wing graduate student now is given instrument instruction before he receives his wings. Instrument training for those already rated has been expanded.

The next step is to establish a nucleus of well qualified instrument helicopter pilots in each airmobile and transport helicopter company in the Army. This can only be accomplished by Department of Army directive. Ground commanders will not willingly devote flying hours to pure instrument training and thereby reduce the number of hours available for operational missions. Of course, many of the instrument training requirements can be conducted during operational missions.

The final step is to designate certain units to conduct experiments and develop doctrine for instrument helicopter operation. These units must be authorized to deviate from existing regulations where necessary.

The adoption of this three-step program will provide minimum essential instrument training to all rotary wing aviators, establish a nucleus of well qualified instrument pilots in the Army, and provide the experience so vital to successful instrument flight during tactical operations.

Looks like a fine day to crank in some instruction in formation flying!

Carry On!

Major Milton P. Cherne

THE DIFFICULT we do today; the impossible takes a little longer.

Adequately trained, equipped, and motivated, the American soldier has performed admirably under many adverse situations from Valley Forge to Muc Hoa, Vietnam. Frequently historians have had to stretch their imaginations to conclude that the word "adequate" was a proper descriptive term to include in their vocabulary when referring to the soldier's equipment. Were the uniforms of Washington's army adequate? Were the smooth bore rifles of the Union Army in '65 adequate? Was the M-4 tank in early WW II adequate? Are present-day helicopters adequate — especially for instrument flight?

Properly equipped, trained, and motivated American soldiers are capable of doing the impossible, even if it takes a little longer. As Army Aviators, we have seen the impossible done in the past on numerous occasions. To accomplish these difficult tasks the inherent aircraft design capabilities were used to the nth degree. Skill, courage, and confidence in equipments are always significant factors. *Proper* equipment will permit accomplishment of the mission.

A realistic appraisal of equipments, both airborne and ground, is necessary before increased capabilities can be realized. New and aggressive thinking, and application of this thinking, is mandatory before any real improvement can be expected in the field of helicopter instrument flying. Each instrument that assists the pilot in maneuvering his aircraft, in effect, is telling a story. They tell him his airspeed, attitude, degree of bank, rate of turn about the vertical axis, whether he is slipping or skidding, and numerous other messages of extreme importance.

The paramount problem facing helicopter instrument pilots is the undeniable fact that too many messages are being relayed to him for mental interpretation, and the messages are frequently erroneous and require additional mental gymnastics to focus them in their proper perspective. (Current helicopter instruments are NOT *PROPER EQUIPMENT!* They are modified fixed wing instruments, which are adequate for normal applications, and are indicative of the lack of imagination and appreciation of the problems currently being faced by the rotary wing program.)

Highly skilled, *highly* trained pioneers in the rotary wing instrument campaign have truly performed impossible tasks. They have proved that helicopter instrument flying is feasible. They have made approaches to the ground under instrument conditions using *highly* skilled radar controllers. Members of the Aviation School have compiled a formidable and impressive statistical record of hours flown during actual weather conditions and simulated instrument flights. However, these men must be described as *highly* skilled also.

Although aviators in the field may be motivated and may possess the skill level that Aviation School personnel have, they will experience extreme difficulty in maintaining the confidence that they need to perform equally well. Why? Because the dictates of their unit commander, supporting commanders, and supported commanders directly

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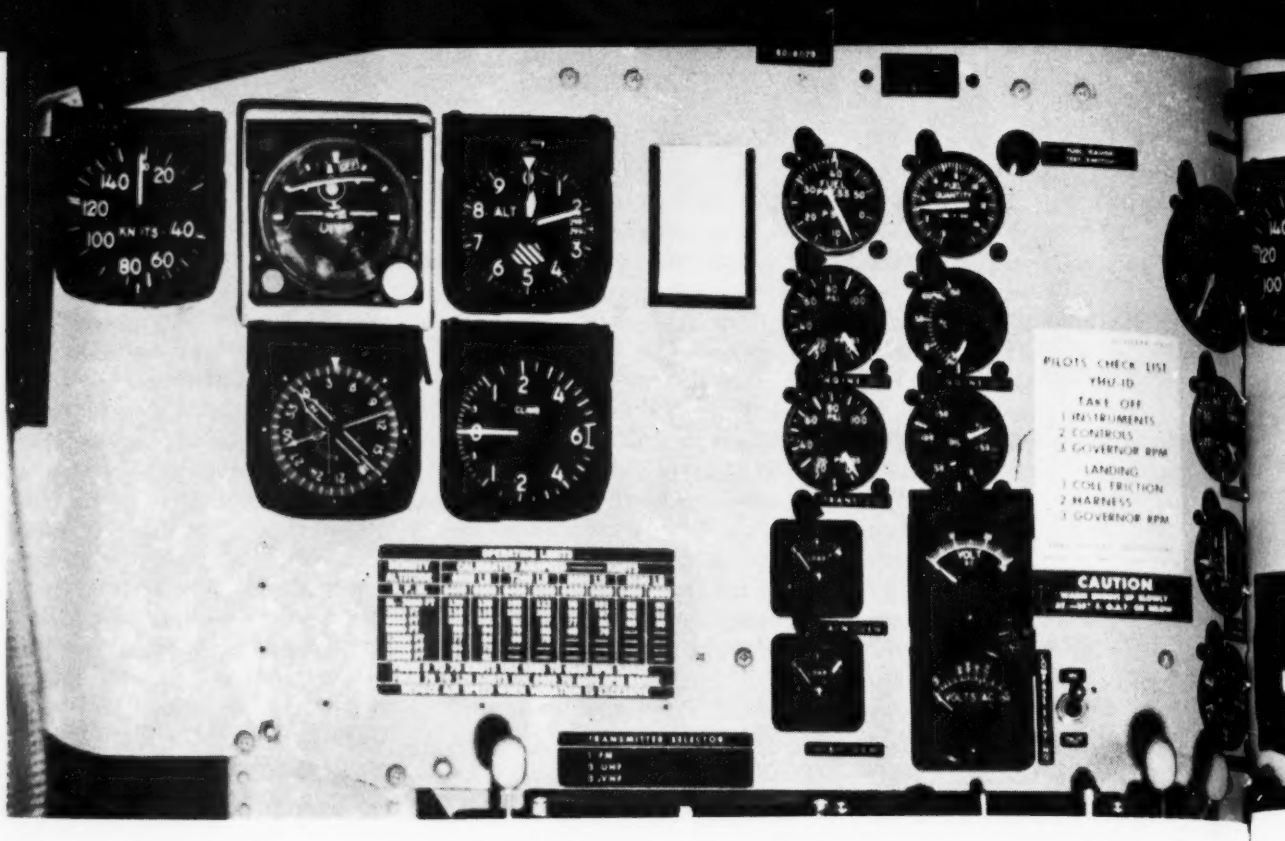


influence where their strongest skills will be developed. Second, the difficulties of helicopter instrument flying with current standard instruments impose a skill requirement on the individual that he cannot maintain unless he frequently and conscientiously practices and applies the knowledge he has absorbed in past training.

Let's examine each of these detractions in its own light. Not with a view of being "it can't be done, Charlie," but with the intent of realistically appraising our objectives and seeking a way toward our goals.

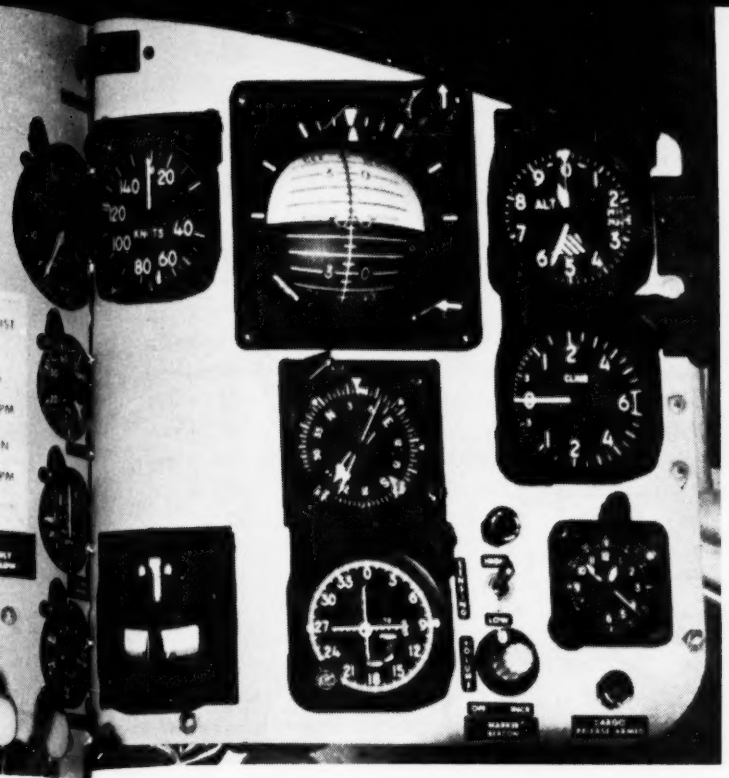
Although a commander is many things to many people, he is not a miracle man. With ingenuity, perserverance, dogmatism, and undeniable devotion to duty, one commander may extract tasks from his unit that another commander cannot. Even so, he is limited in what he does by his mission, equipment and personnel. These are factors established by Department of the Army, and are sometimes inflexible.

The commander's greatest contribution is in the manner that he develops and utilizes his personnel. He is allocated X number of aircraft and wheeled vehicles, plus other associated equipment. He is authorized Y number of people; and, ideally, all of these personnel are exceptionally well trained in their respective fields. Juggling these two factors, he must arrive at a formula that will place his unit in the best possible posture to accomplish M, his mission.

Mathematically, we know that if we have two known factors, we can find the unknown third factor. Applying this simple formula to operational status is not so simple. Indeed, the unknowns far outweigh the knowns. In aviation, M can be an untold number of tasks, functions, and requirements. Where, in the list of priorities that the commander must establish, should he place emphasis on instrument training?

One helicopter unit operating in the delta area of Vietnam was forced to cancel ONE mission in over 6,000 hours of flying due to weather. A sister unit, operating in the hill country, estimated cancellation of less than 5 percent of missions due to weather. A majority of these cancellations were forced on the commander because the objective area was socked in. A commander of a helicopter unit who recently returned from Europe estimated that not more than 5 percent of his missions were cancelled because of weather, although, in many instances, the helicopters were flown into or through weather en route to the objective area.

If the above cancellation factor is true, how can the unit commander be expected to expend his precious flying hours on instrument proficiency and neglect the acknowledged requirement to safely transport personnel and supplies? This in itself is a major problem. New pilots have to be transitioned. External loads must be picked up and transported safely. VFR navigation is a never



Present helicopter instruments are not proper equipment. They are modified fixed wing instruments.

ending training problem, etc., etc., etc.

Supporting commanders in general, and maintenance commanders specifically, influence the use of the commander's aircraft. Is an unreliable attitude indicator a red-X condition? When can you replace or repair a nonworking VOR? How many J-2 compasses do we have in backup support? Professional instrument flying, practiced in accordance with existing regulations, places a heavy demand on supporting commanders. Are the means available to support the unit commander in this phase of his mission?

Supported unit commanders are usually pretty adamant about their desire for aviation support. They want it to be responsive at all times and they want it *there* when they want it. It is extremely distasteful to them to hear excuses (reasons) why you cannot support them. They tend to be indifferent to proficiency flying. It is difficult for them to appreciate why you have overflown your monthly flying program concentrating on weather contingencies when he still has an ATT to conduct. The sky is blue, the winds are gentle, and YOU are going to tell him he can't have the aircraft?

A summary to this point would indicate that the aviation unit commander has a real can of worms to contend with. A valid requirement does exist for Army helicopters to be able to fly without visual reference to the ground, and it is an accepted fact that this requirement will expand as time goes on. It is realistic to say that units cannot maintain peak proficiency in this skill and continue to provide total flying support as they have done in the past. It is not realistic to ignore the 5 percent or more of missions that have been cancelled due to weather.

We must be responsive, but we cannot afford to penalize ourselves and the people we support by concentrating our efforts on 5 percent and shunting the other 95 percent. We cannot afford to accept additional weight penalties for instrument flying. Nor can we accept complexities beyond our capabilities to maintain. We cannot place ourselves in the position of total reliance on a multitude of black boxes. What, then, is the answer?

The answer must be found in ways of reducing the difficulties of helicopter instrument flying. The answer *will* be found in new and unique presentations to the pilot. This (not these) presentation must artificially portray to the pilot the same information he would obtain by looking out of his windshield on a hazy day.

A noninstrument rated pilot must be able to flick a switch just before entering weather conditions and simply transfer his vision from outside the helicopter to the single presentation. The presentation must be completely reliable in order to build confidence in its use. It must be so simple that instrument training will consist of the normal ground school and regulations, plus 5 or 6 hours of familiarization with the presentation equipment.

Microminiaturization of component parts should permit introduction of this equipment at a weight equal to the combined weights of current airspeed indicator, artificial horizon, J-2 compass, etc. Master and slave grid lines on the presentation will portray azimuth and horizon. Colors will portray airspeeds. The pilot will actually see himself flying, just as though he were looking outside.

When is this Utopia coming? Soon — just as fast as the developer can work. Just as hard as we push the requirement for this capability. What do we do in the meantime? Just like we have been doing — the impossible! ☆

When Does An Instructor Take Over Controls?

Major W. W. Vatcher, USMC (Ret)

ACCIDENT FILES are replete with cases where instructors have allowed students to go too far before attempting to take control of the aircraft.

Here is a problem that no

Maj Vatcher was aviation safety officer with Marine Air Group 26 prior to his retirement.

doubt manifests itself many times daily in every organization. Our psychologists tell us that mere recognition of a problem is the most powerful factor in its ultimate removal. To attempt an all out assault on the problem here would be difficult to say the least, but perhaps we would benefit by merely bringing it into the open and conducting a general discussion

The general feeling held by most instructors seems to be that while the student has the controls, the less yakking and less riding of controls by the instructor, the better. This idea is good in its basic concept, but to be effective it must be applied in specific cases rather than on a general level. General application to all students is apt to make the instructor a slave to the idea to the degree that when he should take the controls away from the student in a tight situation his reaction is not fast enough.

This hesitancy to assume control of the aircraft by the instructor could well be a result of experiences which most student pilots had in flight training. The instructor who was always on the controls and always talking was to be shunned like the plague, and few if any students ever went through the flight program without running into one of these characters. The student who has had such experiences is very likely to go to the other extreme when he finds himself in the position of instructor.

This seems to be true of most new instructors. With time and experience he soon learns the ropes and develops a more realistic attitude. So it is with the new instructor that this problem seems to prevail. By new instructor we don't necessarily mean "junior." Many of the senior officers who, upon finding themselves in the position of instructor for the first time or after a long absence from instructing, are just as prone to this reaction as the junior officer pilots.

As a general rule, it is safe to say that whenever there is doubt in the instructor's mind as to the safety of a particular phase of a maneuver he should assume control of the aircraft. Now this statement may sound ridiculous to some because it sounds so trite and obvious. But the sad, well documented fact is that not enough instructors believe it. There seems to be sort of a hypnotic effect on some instructors when confronted with a tight situation. Search your memory you instructors and see if you can't recall similar hypnotic spells on your part where if you had it to do over again there wouldn't be any hesitation. Then there are those occasions where you knew darn well it was going to be close but you just couldn't bring yourself to take over — you decided on the spur of the moment to chance it — to bull your way through. It's sort of the same kind of mixed up thinking that many single engine pilots use when they decide to try to salvage a lousy landing. It's just mixed up thinking and in many cases an out and out case of inability to make a decision fast.

The real trick of course is to be able to anticipate rough situations just moments away and then take over. There should be no excuse whatever for an instructor allowing events to take their natural course when there is the slightest doubt in his mind as to the outcome of the maneuver.

In helicopter flying this tendency probably shows up mostly during autorotations or during landings where there is a high sink rate.

In an autorotation, for instance, if there are trees between where the throttle is cut and the intended recovery spot, an instructor should be able to tell as soon as a descent is established whether or not the student is going to be close to the trees. If it is going to be close the instructor should either tell him to go around or take over himself. There is no excuse in this world to allow the autorotation to continue if there is any doubt at all about proximity to the trees. Yet this continues to happen almost daily. Ask any instructor if this isn't true. Along these lines students should initiate their own go-around if things aren't right. He has a responsibility here as well as the instructor.

There are many flight situations when the student isn't performing the maneuver just right the instructor can afford to let him keep the controls and learn for himself. The good instructor should learn to distinguish between these situations and give the student as much leeway as is consistent with safety of the aircraft. There is no better way to learn than to get fouled up and get yourself unfouled by your own efforts. But wrecking an aircraft isn't in this category, and if the instructor is worth his salt he won't allow you to get into such a mess.

It hurts a man's pride to have the controls taken away from him just when he thinks he has it wired, but the responsibility that goes with signing for an aircraft that costs several hundred thousand isn't small. Instructor and students alike should realize this, and students should give him the benefit of the doubt when he acts accordingly. ☆

Captain Lawrence F. Beyer completed flight training in the U. S. Air Force and flew B-47s, B-52s, T-33s, and U-6s for five years before he transferred to the Army last March. He recently completed Army Aviation qualification training at the USAAVNS and wrote this Crash Sense article while TDY with USABAAR.

We asked Captain Beyer to research the USABAAR accident files for examples of winter hazards and write this month's CRASH SENSE. Here is his . . .

The Icy Grip of Winter

Captain Lawrence F. Beyer

THE "SPRITES and goblins" of this winter's tale are not the ones Mr. Shakespeare had in mind. But they are even more capable of contributing to the sad tale for an Army Aviator than are the hobgoblins about which the bard wrote. The effects of icing, both structural and carburetor, low ceilings and visibilities, snow on runways and taxiways, and freezing temperatures present hazards each winter to trap the unwary aviator in the icy, and all to often deadly, grip of winter.

So, as the season of jingle bells and snowmen approaches once again, it would pay us to review the hazards of winter operations. They say experience is the cheapest thing in the world to obtain — if you are smart enough to get it second hand. With this in mind, let's do some bargain basement shopping through the files of USABAAR.

crash sense

PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

a sad tale's best for winter;

I have one of sprites and goblins

—WILLIAM SHAKESPEARE

CARBURETOR ICE—O-1

"At 1240 hours I lined up on the runway, lowered my flaps for 30° and turned on the electric fuel pump. I set the brakes, advanced the throttle and, after reaching full power, I released the brakes and started my takeoff roll. Just prior to the aircraft's becoming airborne, and with too little runway left to land, the engine began to miss. I completed my takeoff and, after reaching altitude, I raised my flaps but left the electric fuel pump on. I radioed the flight leader and told him I was returning to the field and making a precautionary landing. I then radioed the controller at the field and informed him I had engine trouble and was returning.

I flew a tight pattern, to be able to make the field should the engine quit, and scanned my instruments for an indication of the trouble. All instruments were in normal operating ranges. Upon turning base leg, I applied carburetor heat prior to making a power reduction and the engine quit. I nursed the throttle back and forth trying to get it to run again. The engine would sputter, run for an instant, and then die again.

"About 50 feet from the ground, I started concentrating on my landing and had resolved myself to a dead-stick touchdown. At roundout, the engine came back in. The power surge threw the

nose of the aircraft up and I corrected. The propeller was bent during touchdown. The landing was hard and I momentarily lost directional control. At this time, I still did not know that the aircraft was damaged. The engine was running and I applied power to attempt to taxi the aircraft off the runway to try to determine the cause of the engine failure. The aircraft would not move and had to be moved off by hand. Had it not been for the power surge, the touchdown would have been normal."

This one could have probably been prevented completely if the aviator had thought to put on carburetor heat for a few moments just before takeoff. Carburetor icing is especially insidious in an aircraft without a manifold pressure gauge or carburetor air temperature gauge. For this very reason, we must be all the more alert for it. By the way, the power surge that demolished this aviator's reasonably competent handling of his emergency could have been easily prevented had he remembered to accomplish his emergency procedures and completely shut down the engine once he had resolved himself to a dead-stick landing.

LOW CEILINGS—OH-13

"At 0715Z I called the weather forecaster to obtain a forecast for the destination area. Previous forecast at 0530Z indicated that high ceilings south of us would allow fog, which covered the local area, including my departure airfield, to dissipate. This proved to be an accurate forecast since, when I checked at 0700Z, departure weather had improved sufficiently to allow VFR flight (1.5 nm visibility).

"At 0738Z, I took off. The weather was good, with the sun shining through a very high thin layer of broken clouds, and ground visibility was 4 to 5 miles.

"Proceeding north along the highway, the visibility remained at 4 to 5 miles until I was some 12 miles north of a small town, where it dropped to approximately 2 miles. Just prior to reaching the highway turn-off, I could see what appeared to be an area of extremely low visibility ahead. I turned around, intending to fly south along the highway and to either abort the mission entirely or proceed to a field site if weather permitted. The fog increased until the visibility to the south decreased to one-half mile, and occasionally to one mile. I reduced airspeed to approximately 40 knots and, firmly believing I was high enough to clear known obstacles in my path, I continued south. I suddenly saw a string of lines directly ahead at my level. I put the aircraft into a sharp right turn and narrowly avoided the wires, but flew into heavy fog over deep snow. I immediately lost all reference to the ground.

"Since this aircraft had no attitude flying instruments, I looked for something to use as a horizon and could find nothing. At the same time I attempted to gain altitude because I knew the fog to be thin, as the sun had been shining through it in several places along the way.

"A short time after entering the fog, I was suddenly faced with a line of trees which were directly in front of me. The position of the aircraft was approximately midway between the ground and the top of the trees. I had time to pull back on the cyclic for a nose-high impact. When the aircraft settled to the ground, my passenger and I evacuated. Seconds later, I stepped back into the aircraft and turned off the switches. We walked to the highway and caught a ride to a military installation."

Perhaps this aviator was lucky that he hit the trees. Had he continued in AI conditions without flight instruments, the odds are more than even that spatial disorientation would soon have taken over, causing the OH-13 to plummet out of control to the ground with two fatalities rather than two minor injuries.

ICY TAXIWAYS—U-6A

"We made a thorough preflight and found no discrepancies. The copilot, a passenger, and I boarded the aircraft. We completed the cockpit check and started the engine. After a radio check, I started moving forward to check the brakes. Due to the slippery condition of the taxi area, the aircraft slid forward when the brakes were applied. Moving forward toward the southeast taxiway, it was necessary to pass between two large snowdrifts. I attempted to place the aircraft in a position to pass between the snowdrifts without turning. There was an incline just prior to reaching the taxiway which required an addition of power. As we reached the top, the aircraft slid to the left and struck a snowdrift. I felt it hit the drift, but thought that the tail wheel had hit a rut. No increase in power was needed to continue down the taxiway.

"I made a comment as the aircraft struck the snowdrift to the effect that I thought the right brake was locked, because I felt that we were sliding on ice. The copilot commented that he noticed that the right wheel was sliding on ice.

"While waiting for our clearance, the division aviation officer requested a runway surface check. The detachment operations officer made this check and it was determined that the runway

was not suitable for use. The flight was terminated and we taxied back to the apron in front of the hangar. At this time, the damage to the horizontal stabilizer was brought to my attention by the operations officer."

Deciding the runway was unsuitable for operations after an accident has happened is like locking the barn door after the horse has run away. However, as FAR, Part 91 puts it, "Nothing relieves the pilot from his responsibility for safe operation of his aircraft."

BLOWING SNOW—CH-34

"We arrived at our intended landing site at approximately 0730 hours. After flying over the landing area I elected to land to the west into the wind which was west, southwest, at approximately 10 knots. However, in the immediate landing area, surrounded by buildings, the wind was 5 knots or less.

"The helipad was covered by 4 or 5 inches of fresh powdered snow. I planned my approach to the ground. However, as I neared my intended touchdown point, the rotorwash began blowing the loose snow up around us. Forward visibility was reduced to near zero, but we could still see the ground directly below.

"At touchdown, which I considered normal, the aircraft began to vibrate and move slightly forward and the copilot applied brakes. But to no avail. The tail of the aircraft suddenly swerved to the right, and the main rotor blades began striking some posts which were bordering the west edge of the landing zone.

"The copilot cut the mixture as I started turn-

Choctaw trapped well on screen play, but drew long penalty for clipping goal posts

"The runway appeared to be clear except for an inch or less of new fallen snow"

ing off the switches. We tried to apply rotor brake but it was inoperative.

"The copilot and I hurried down the steps into the cabin and saw that the crewchief was not injured. I then got out and saw that the tail rotor was off and the tail pylon was lying over to the right side."

Helicopter pilots must always be aware of the hazards of reduced visibilities caused by rotorwash. This is particularly true in winter operations because of the constant presence of snow just waiting to be swirled up to produce zero-zero landing conditions.

MARGINAL VFR AND DEEP SNOW—O-1E

"I filed a flight plan with and received a weather forecast from the FAA. The en route forecast was for scattered snowshowers with ceilings of 2,000-3,000 feet, and visibility 3-5 miles, lowering to 500 feet and 1 mile in showers. Destination weather forecast was VFR.

"Immediately after I hung up the telephone, a transient pilot informed me that the weather in my en route area was good, but that a large snowshower was located south of us. I filed a flight plan, VFR direct, with 1 hour and 45 minutes en route.

"When I contacted the tower for takeoff instructions, I was informed that a snowshower was moving in from the west and that they would give me a controlled VFR departure. The ceiling was approximately 2,000 feet, with visibility varying from 1 mile (west) to 5 miles (east).

"I elected to proceed with the flight and circumnavigate the snowshowers. I turned east after takeoff and departed the snowshower area almost immediately.

"Approximately 20 minutes later, I encountered another snowshower and elected to circumnavigate it in an easterly direction. After approxi-

Winter, which being full of care,

makes summer's welcome thrice more wish'd, more rare

—WILLIAM SHAKESPEARE

mately 20 minutes, flying into increased headwinds caused by the counterclockwise flow around the snowshower, it became evident that my deviated route and decreased groundspeed would not permit arrival at my destination prior to darkness.

"I checked the map for a suitable airfield to terminate the flight and attempted radio communication with surrounding FAA radio stations and control towers to get a new weather forecast. I was unable to establish radio contact due to my remote location, mountainous terrain, and low-power equipment.

"When I arrived at the field I had selected, I called again but could not establish contact. I made a low pass to determine runway conditions. A light snow was falling. The ceiling was approximately 1,500 feet and I could see about 3 miles. The runway appeared to be clear except for an inch or less of new fallen snow. I could also see what appeared to be wheel tracks, and aircraft were parked on the ramp.

"My landing approach was normal. I considered the possibility of the snow being deep and made sure I touched down with elevator control in the full aft position. Immediately after touchdown, the main gear dropped suddenly, and the aircraft flipped over and came to rest upside down. I turned off all the switches and got out.

"The snow coverage on the field varied approximately 6-14 inches deep, with a hard crust under the 1 inch accumulation of new fallen snow. The landing gear had broken through the hard crust over the deepest snow. The airfield operator told me the runway had not been cleared due to operation of ski-equipped aircraft. He said this had been authorized by proper authority."

This aviator certainly overextended himself by flying into marginal VFR weather. His decision to make a precautionary landing was sound, but his choice of fields was, to say the least, unfortunate. The airport operator stated that his airport was used *only* for ski operations during the winter and the runways were intentionally left uncleared. However, there was no notice of this published in Jeppesen charts, sectional charts, or NOTAMs.

This last episode is not from USABAAR files but is from my own experience.

I was copilot in a U-6A that was to make an administrative run from a western Air Force base to El Paso, Texas. Weather was 300 and 1 at takeoff with en route weather forecast to be AI with "light, occasional rime icing." Destination was VFR. No sweat. Right?

Wrong!

Fifteen minutes after takeoff, we were at 6,000 feet and ice was beginning to accumulate on the wings and struts. It didn't appear too bad, but we were needing more and more power to maintain airspeed. Finally, we were at METO power and just staggering along at 80 knots. I suppose the fact that an 8,800-foot MEA was ahead of us finally convinced us that discretion was definitely the better part of valor.

We requested and received a clearance back to our point of departure. A quick 180° turn and we were again in a no-sweat condition. But now the plot thickens. The weather had deteriorated to 100 and ½ with winds 90° off the runway heading at 20 knots, gusting to 30.

GCA picked us up 15 miles out and gave us a faultless straight-in approach. With the ice on the runway, we were able to maintain fair directional control by landing in a 10° crab. But I'm glad the runway was 13,000 feet long and 300 feet wide.

We taxied in and shut down. The transient alert mechanic said he didn't think an airplane could fly with that much ice on it. As a matter of fact, neither did I. We had between 2 and 3 inches of ice on the leading edge of everything. We closed our flight plan, chalked one up to experience and headed for the bar.

Winter presents definite and specific hazards that are usually not with us during the rest of the year. As professional aviators, we must not allow ourselves to become boxed in by circumstances, the weather, or our own lack of proficiency. The monkey is squarely on our back to be aware of hazards, to plan ahead, to be proficient, and to avoid overextending ourselves.

When you stop to think about it, the same monkey is always on our back. In winter, he's just a little bit heavier. ☆

Maintenance Man On The Aviation Team

Gerard M. Bruggink

THE STATUS of the aviation mechanic has a lot in common with that of a brand new father whose keel-laying role is completely ignored in all the fuss about mother and child. Of course, everybody knows that a father had to be somehow involved, but who cares about background routine in the spectacular process of a baby's birth?

When aviation was still in its infancy, or in the maternity ward, it was logical and proper that the pilot got all the credit since he played the triple role of father, mother and midwife! In those days it was the pilot's guts and willpower, more than aerodynamic principles, which kept the weird collections of nuts, bolts and string airborne.

Fortunately these days are gone. Aviation has come of age; it is no longer a lone wolf or a superman who roams the skies. Now it's a professional *team* which specializes in the operation of aircraft and production of missions. Although the pilot still absorbs most of the public's admiration, it is difficult, if not impossible, to decide which member of the aviation team plays the

it is difficult, if not impossible, to decide which member of the aviation team plays the most critical role

most critical role. The growing complexity of our machines has given ground personnel a responsibility that is at least equal to that of flying personnel.

The trend to underrate the importance of the man with the toolbox is also evident in our accident prevention campaigns. We are always looking for a pilot audience, probably because the pilot, statistically, is highest on the list of accident cause factors. Does this mean that maintenance people make fewer errors, or that our statistics give a false view?

Let's take some examples:

• A pilot takes off in an aircraft with the ailerons rigged in reverse. Before he knows what hits him the aircraft is slow-rolling through the grass and shedding its wings. Who gets the blame? Theoretically the pilot — because he was the last member of the team who could have, and should have, noted this maintenance blunder. But no self-respecting mechanic would suggest that this approach presents the true picture.

• Another pilot takes off without checking the security of the oil filler cap because the line chief told him that it was properly closed and safetied. One hour later the engine seizes as a result of oil starvation. The oil filler cap had not been properly secured. Who gets the error? The pilot of course.

But what happens to our team concept when we can't rely on each other?

A few weeks ago I was in a hospital to question a crewchief who was injured in a helicopter accident. After he had given a very clear description of what happened, I asked him if he could think of anything unusual about the aircraft that could have contributed to the accident. The way he looked at me convinced me, too late, that this normally routine question had insulted the man's honor. I got the answer I deserved: "Sir, we do not operate a flying club. Before I sign off for an aircraft, I ask myself: 'Would I let my kid brother fly this ship?' If the answer is no, I won't release it."

Here was a man who spoke with pride and confidence, although he had just gone through a rough experience. His reference to the almost forgotten concept that we still are our brothers' keepers also showed that he was a conscientious team member. It is refreshing to know that in a society that measures success in terms of dollars, pride in craftsmanship still finds a place.

Those of you who'll go into the field for the first time may have difficulties finding your place on the team. Here are a few hints.

Don't expect the commanding officer, the maintenance officer or the shop foreman to fall around your neck and greet you as the unit's last missing link. Things aren't quite that bad in our fast growing organization. The men you'll meet are probably too busy for long welcomes. Before you can write your wife, "wish you were here," you may already have been assigned to a slot that is normally filled by two persons.

Don't expect clear-cut orders for every move you must take. Your qualifications are recognized, but you are expected to know the limits of your experience. This means that not every time you lockwire a nut, or fill out a form, somebody will be looking over your shoulder. It also means that you must set all false pride aside and not hesitate to consult your maintenance sergeant whenever you have any doubt about the correctness of your work.

Don't think that the world, or your career, has come to an end every time a tech inspector growls at you. This man has to bear the responsibility for the work you have done, and he can't afford to be courteous about errors in a job that deals with human lives. He knows that soft-pedaling a minor mistake is a sure invitation to blunders that scatter people and airplanes all over the countryside. By the same token, if this man tells you: "Private Chatman, you did a pretty good job on this machine," you can practically consider yourself decorated!

Don't flatter yourself with the thought that what the school taught you is all you need for a successful maintenance career. The diploma you will receive is like a marriage license — the official stamp of approval to exercise your skills, not a guarantee for success and happiness. Careers are not built with a handshake and a piece of paper. You've got to work at them. To

prove this point to yourself, I invite you to do a little research as soon as you arrive in your unit. Talk to the gripers and the soreheads and find out why they failed. You'll always find that these people don't have the get-up-and-go to increase their knowledge "beyond the call of duty."

If you are sincere about succeeding and being a respected team member, deny yourself some of that high-level TV entertainment once in a while and read your manuals. Nobody can be blamed for not having all the answers at his fingertips, but you can only blame yourself for not knowing where to find them.

Don't take it for granted that rank and position keep a man from making mistakes. On the other hand, don't think that the lower the job, the less the chance of serious blunders. I know cases where people, qualified only to push an oil rag, have caused accidents by bending control rods or leaving rags in engine intakes.

In aviation, we must treat every error as though it will cause an accident. A mechanic lost a ½-inch bolt while working on the control system under the cockpit floor. To save time, he got a replacement bolt and completed the job. A few weeks later the pilot of that aircraft had some anxious moments when he found the ailerons jammed during a stall recovery. Luck and a competent pilot kept the aircraft near enough intact to determine that the lost bolt cost the taxpayers $200,000.00 by finding its way into the aileron controls.

Don't assume that just because a thing came apart in a certain way that it should be reassembled the same way. It might not have been put together properly in the first place! Unless you know your tech orders by heart (and who does?) use them all the time. Nobody is going to get mad about a few greasy thumbprints on the pages. If there is one thing I distrust, it is a maintenance shop with manuals that look as if they have never been used.

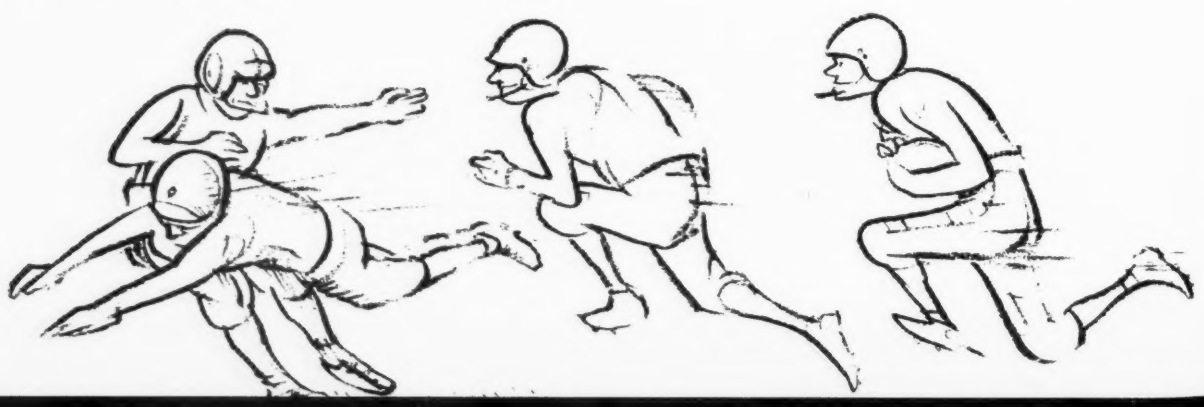
Don't act in your own aircraft as if you were just another passenger. Remember that you are part of the crew and that your cabin passengers, regardless of rank, look upon you as a man of authority. You may have to deal with passengers who have never flown before and are scared stiff. They need your help, even in such simple matters as the adjustment of the seat belt. They want to know where the emergency exits are and how they are operated — though their pride won't admit this — so you might as well give them the straight dope right from the start. A thorough briefing will do more to ease their fears than cockiness and ridicule. And when the pilot, before takeoff, gets on the intercom and asks, "Foster, everything OK in the rear?" you should be able to answer, "Yes sir! I got 'em all tucked in and happy!"

Finally, a word about the mechanics' trademark, the toolbox. You have undoubtedly heard it said that you can tell a maintenance man by the way he keeps his toolbox. This is so true that an old hand in this business can learn more about you by a quick glance in your toolbox than a head shrinker can find out in a week-long session on a couch. On a larger scale, the same applies to housekeeping in the hangar, on the flight line, and in each aircraft. A man who keeps his tools neat works neatly and thinks neatly. A cluttered up workshop stands for cluttered up minds.

One of the oldest Dutch steamship companies uses a double action motto: IT'S GOOD TO BE ON A WELL-RUN SHIP. This appeals to passengers as well as crew members. I hope that you'll make this your motto, because there is no better way to express professional pride. It also gives you a chance to experience one of the greatest satisfactions in your career — a passenger who taps you on the shoulder as he leaves your aircraft and says, "Specialist Rhodes, you sure run a good ship."

When this happens, don't forget to tell the men in the cockpit about it. There are still a few things in this world that money can't buy. ☆

Blockers are important cogs in a well disciplined team. The professional aviation mechanic is equally important in Army Aviation safety.



A Chance to Stir the Pot

WHEN IT COMES to aviation training literature, the more cooks stirring the pot, the better the broth will be.

Have you found current aviation training publications not quite to your taste?

If you feel the ones we have are obsolete, or in need of reorganization — do something about it! You can, you know.

The U. S. Army Aviation School will evaluate your personal suggestions. If you think we need a new field manual, a new technical manual, or any other of the several types of DA publications, you can write the School instead of just complaining to anyone who happens to be around.

Recognize, however, that suggestions concerning publications gain in validity if they have been previously staffed in your own unit or at least among several people who are vitally concerned in the area involved.

In January of each year the U. S. Army Aviation School formalizes the Army Aviation Training Literature Program for the next two years. Proposals, whether changes or completely new manuals, are submitted to USCONARC for initial approval and then by that headquarters to the Assistant Chief of Staff for Force Development, DA. While awaiting formal approval, the School begins research and development of the proposed changes, revision, or new publications.

One thing to remember before submitting your suggestions is that the Army Aviation School is not responsible for all publications dealing with Army Aviation. For example, TMs on specific items of equipment, such as aircraft operators' manuals, are not prepared by the School. Recommendations concerning these should be submitted to the originating agency shown in the first chapter of the publications.

With these cautions in mind, go ahead. Address your suggestions to the Commandant, U. S. Army Aviation School, ATTN: AASPI, Fort Rucker, Ala., 36362.

P. S. For more information on the types of Army publications and how they are prepared, see AR 310-1 and 310-3.

ANNUAL INDEX AVAILABLE

The U. S. ARMY AVIATION DIGEST 1964 Index is available by request. Address: Editor, U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Fort Rucker, Ala., 36362.

CV-7A Arrives At Rucker

The CV-7A Buffalo, which may carry the Army name "Cheyenne," gets off the ground quickly with highly efficient General Electric T64-10 engines rated at 2,850 ESHP takeoff power.

CV-2A Caribou

Outstanding stability and control at very low airspeeds allow the CV-7A to make safe approaches into confined areas. Lift spoilers activated on gear touchdown, destroy wing lift and, along with reversible props, enhance the CV-7A's short field capability.

THE ARMY is getting its first look at the CV-7A transport aircraft which is undergoing service test at the U. S. Army Aviation Test Board, Fort Rucker, Ala.

Commercially designated the DHC-5 Buffalo by de Havilland, the aircraft is undergoing a 25-50 hour preliminary test to determine if it can meet Army requirements that it "live" in the field with the troops.

The Army has purchased four of these turbine-powered aircraft. Three are now flying, and current plans call for all to be delivered to the Army by next spring. It is expected that a more extensive service test — in the neighborhood of 500 hours — will be underway by then.

As shown in the accompanying photos, the CV-7A resembles its sister ship the CV-2B Caribou, a reciprocating engine transport which was obtained by the Army from de Havilland in 1958 (see DIGEST, Nov 1959). The most noticeable differences between the two aircraft are the tail assemblies, the wings, and the engines.

PHOTOS BY DE HAVILLAND